BUILD A WACO MODEL "E"!

June 1989

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ON THE COVER:
The sparkling silver finish of Joe Roselle's rare Waco YPF-7 is caught over the lush fields of Oshkosh by ace lensman, Budd Davisson. A derivation of the popular UPF-7 pilot trainer, the YPF added 35 horses, courtesy of Jacobs, to the 210 of the Continental, and provided creature comfort (for the pilot anyway) in the form of an enclosed cockpit equipped with a sliding canopy. A Waco of a different (and smaller) variety is that of the "E" type, modeled in large scale by the 4th-place winner in our design contest, Douglas Hobbs. The broad appeal of biplanes is universal, and although most of us will never own the real thing, modeling allows everyone the opportunity to fly one. Kodachromes by Budd Davisson and Douglas Hobbs.

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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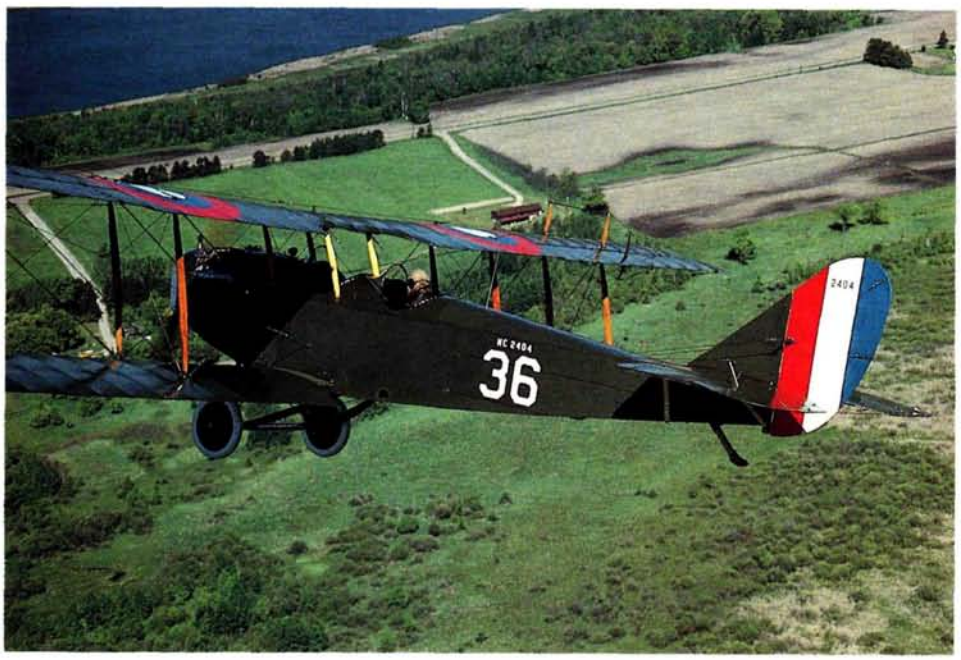
Editorial

by RICH URAVITCH

YOU REALLY SEEM PLEASED with our frequent theme issue presentations, which have included trainers, ARFs, helicopters and, most recently, jets. We really enjoyed putting this one together for you. It centers around what, to many of you, is the *only* kind of airplane worthy of the name...the *biplane*! When you look at this particular type of flying machine—*closely* look at it—some unique qualities emerge. Beyond the obvious characteristic of having two wings, look at the broad range of types. The original Wright Flyer had two wings, and the entire length of its historical flight wasn't much more than the combined wingspans of a small number of the appropriately named Canadian aerobat, the Ultimate Bipe. Between these two fixed points lie dozens upon dozens of famous (and infamous) double-wingers, e.g., Fokkers, SPADs, Nieuports and Tommy Morses of WWI, barnstorming Jennies, Standards and Travel Airs that so captured the hearts and minds of an inquisitive, but not yet convinced, general public. The Golden Age followed, and this found the military operating some of the most beautiful tactical aircraft ever conceived. Who can deny the aerial art form of such biplanes as Curtiss' P-6E Hawk? How many of you labored for endless hours by dim light, cutting out the exact number of scale ribs printed on 1/32-inch sheet balsa contained in the Cleveland kit? I know my dad did. He told me about it when I first started building models and reminds me of it to this day. His workshop tells the story: His P-47 is surrounded by a stick-and-tissue Stearman, a Tiger Moth, an Al Williams' Grumman Gulfhawk II and a Curtiss Racer.



One of the nice things about biplanes is that there's something for everyone: From the slow, stately grace of the Wacos to the bang-your-head-against-the-canopy, eyeball-popping performance of the Pitts, *some* type of biplane always appeals to the modeler. We've tried to bring you a broad range in this issue. For the scale scratch-builder, there's the classic "E" series cabin Waco, and the Field and Bench repertoire offers small, large and high-performance biplanes to whet your appetite. There are lots more out there...give one a try; don the helmet, goggles and white scarf—experience the fantasy!

Next month's issue is it, radio fans! *MAN* is getting larger with the addition of a new helicopter section, which we plan to make a permanent occurrence with each future issue. We believe that helicopters will continue to experience the growth that we've witnessed, and that they deserve additional exposure. Being a fledgling heli flier puts me right there with most of *MAN's* fixed-wing readers: I have the same questions that many of you have, and those are the questions that we asked experienced heli fliers to answer for us. The purpose is to inform. Like many of you, I admit that I looked, if not down my nose, certainly with less than exuberant enthusiasm, at helicopter activity—until I tried it. R/C helicopters are exciting, sometimes frustrating, but *always* a challenge. Like other specialized forms of aeromodeling, e.g., pylon racing, ducted fans or pattern flying, helicopters probably aren't for everyone, but I'll just bet that a lot of you would enjoy it. For those of you who think differently, *MAN* will still provide you with what you've come to enjoy; we're just broadening the possibilities! ■

Airwaves

WHERE TO WRITE TO US

If you're writing to the editors (and we'd love to hear from you), please be sure to address your letters to "Airwaves" *Model Airplane News*, 251 Danbury Road, Wilton, CT 06897. Only subscription orders and inquiries are handled by our Customer Service Department in Mount Morris, IL; other mail addressed there must be forwarded to Connecticut, and this leads to long delays.

Whether to Weather

It seems that there's an interesting tendency to build "showroom" planes today. No, not those modelers who just build and fly for fun; *they* build planes that fit their abilities and desires, which is fine. However, there are modelers who enter all those major competitions (Scale Masters, etc.) with hopes of capturing the No.1 spot. The competition is apparently very tough, and accuracy to detail as well as excellent flying ability are prerequisites, with one exception: weathering. The planes look very similar in that (with few exceptions) they look like they just rolled off the showroom floor.

There aren't too many full-size aircraft that fly regularly and don't show signs of use. Many of the articles written about these R/C tournaments harp on the realism and exactness of these models in comparison with their full-size counterparts. However, shiny tires, spotless struts, residue-free exhaust systems, absence of maintenance panel marks, and invisible fuel stains can hardly be considered accurate. *Real* planes have *real* stains as well as footprints, leading-edge debris, leaking struts, panel scratches and really visible fuel stains.

These model planes might be very accurate as far as shape, scale size, etc., go, but they sure aren't anywhere near accurate as far as wear and tear is concerned, when compared with their full-size flying counterparts. This seems unusual, considering the amount of time modelers spend researching, documenting and building these contest aircraft. Maybe builders are just being *selectively* accurate.

Real aircraft fly in the real world of rocks, rain, bugs, maintenance workers and fuel stains. Modelers who harp on their ability to accurately reproduce, at least outwardly, a scale (or otherwise) model, might do well to walk around their local airport. Real airplanes hardly remain pristine very long. Learning how to properly weather a model airplane might increase your static score, i.e., if you're really striving for accuracy.

ERIC J. JOHNSON
Naperville, IL

Eric, when you look at the very scale competition you describe, I think you'll find that the builders duplicate not only the shape and scale size, but also the weathering effects that appeared on the full-scale version of the airplane. Many of the models seen in competition (warbirds included) are frequently replicas of restored airplanes, and their owners don't even think about getting them dirty! Take a look at some of the airplanes that show up at the major full-scale air shows like Oshkosh. As we compete with our models, so do the owners of the real birds. Most current restorations are clad in space-age materials like high-gloss polyurethane finishes, and the natural-aluminum show planes are polished to a mirror-like gleam. If that's the version the modeler chooses to duplicate, that's what you'll see in the judging circle. I personally prefer the weathered look and, although I'm sure I'll get some reaction from the other scale fans out there, I'll also say that it's much more difficult to create a realistic, not overdone, weathered look on your airplane than a sparkling, pristine finish. The photo of my TF P-51 shows weathering techniques that I

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used 12 years ago! That's what this whole R/C thing is all about, isn't it...creating what you prefer?

RAU

Swoose Seaplane Search

I saw a plane featured in the October 1946 issue of *MAN*. It was a free-flight sea plane called the Swoose, and it had a 31-inch gull wing. I'm wondering if you have plans for it.

GARY SMITH
Chula Vista, CA

Gary, interestingly enough, ace modeler and good friend Nick Ziroli admits to building one "a few years ago," and he flew it right here on Long Island Sound. So impressed was Nick with its performance that he's enlarged and updated it, thrown in a radio and plans to give it to us later this year as a construction article for our annual Floatplane Issue. Watch for it.

RAU

1989 QSAA Dates

As president, on behalf of QSAA, we wish to thank you, and especially Dick Phillips, for the splendid article on the 1988 Fly-In in the February issue.

Plans for Fly-In '89 are almost complete, and it promises to be an even bigger and better event, scheduled for October 26-29 with more foreign entrants. Thanks again, and hope to see you in October.

DON MIGUEZ
President, Quarter Scale Association of America

Don, you're very welcome. We only wish we could have used all the photos that Dick provided of your "Giant" event. Best wishes for continued success with the '89 edition.

RAU

Futaba/World Connection??

I own a World Engines Expert model radio set, which I purchased for my first plane. I'm now becoming interested in rotary-wing flight, and would like to know if there are any gyros that I can use with my radio. If not, I know some of the third-party manufacturers sell servos that will work with several different types of radios; if the only difference between the servos is the connector, and the electronics are the same, does this mean I could just replace a Futaba gyro's connectors with World ones?

I've subscribed to your magazine only for a few months, but I enjoy it very much. Thanks for the help.

BRUCE BOCKIUS
Hopkinton, NH

Bruce, electronically, servos are basically the same, which is why there are many "after-market" units available, usually at a cost somewhat lower than the "prime" manufacturers similar item. With the higher price usually comes higher speed, better resolution and tighter deadbands. Using the proper connector-wire coding, there's no reason why a Futaba gyro wouldn't work with World connectors.

RAU

Big Electric Fan!

I compliment your staff on the best publication for the R/C enthusiast. I'm a relative newcomer to airplanes, having transitioned from cars. I have an electric trainer, but it doesn't have the power I had hoped it would have. The aircraft I'd like to build are in the .40 to .60 2-stroke gas range and, right now, it doesn't seem possible to build an electric in this size. Any suggestion or comments?

Keep up the good work!!

SGT. THOMAS RIVERA
Camp Humphreys, Korea

Your electric trainer, although you didn't mention the specific model, is probably typical of the type. It's carrying a lot of battery weight and is probably equipped with a stock motor and off-the-shelf prop.

(Continued on page 10)

Airwaves

Your experience with R/C cars has probably already taught you what you can do to increase performance: go to a hot-wind motor, up the cell count and experiment with gearing—in this case, propellers. Larger electric-powered airplanes are indeed practical and, in fact, are becoming more so every day. Cobalt motors and high-capacity cells have made great performance a reality. We've got an electric issue of MAN in the works, and this should help out.

Incidentally, Tom, what kind of gas range is a ".40 to .60 2-stroke"? Mine's electric and it's a Hotpoint.

RAU

Gee Bee Plea

I'm trying to find plans, or a kit, of my favorite airplanes: the Gee Bee R-1 and the Gee Bee Z, and I thought you or your readers might be able to help me. I'm 13, I've been flying control-line for about three years, and I want to get into R/C.

ROBERT McNAB
P.O. Box 97
Brewster, MN 56119

Robert, I've seen plans listed for the Gee Bee R-1, but I don't recall exactly where. We'll print your address in the hope that our readers can help. In the meantime, we've fowarded a copy of your letter to Henry Haffke who has to be one of the leading experts on the Gee Bee series and has, in fact, published a number of Gee Bee R/C designs, two of which were kitted by Coverite. We publish plans No. 8851, which is the "Time Flies" version. Keep us advised on your progress.

RAU

Kit-Bashing Captain

I'm enclosing a picture of my latest twin project: the Aerostar 20-20. It started life as an Aerostar 20 kit, and with only a few mods to the basic kit and the addition of the engine nacelles, it was ready to fly. The mods were as follows: increase rudder and elevator by 1/2 inch, carry center spar and sheeting to just past each nacelle, add dural gear to carry a little extra weight, and fill the nose area with blocks to round it off. The nacelles are of a simple tried-and-true design of my own using only 1/4-inch balsa sheet and a plywood fire wall. The leading edge of the wing is cut out back to the spar to make enough room to get the tank in and out. The engines used on the prototype were O.S. .20 4-strokes. At just over 5 pounds, this little

jewel flies great!

The plane will do anything in the book, short of wild outside maneuvers, and it has held up well during more than 100 flights. As an Air Force pilot, my time is limited, and this kit was very quick to build—10 days, start to finish.

A few things were interesting to note with this kit: First, the balance came out according to the plans, with no nose weight added. Second, a 4-stroke twin sounds super! My previous twins have all been 2-strokes of the .40 to .60 size, and even though they *sound* mean, *this* little gem sounds *real*. Kudos to Midwest for a super building and flying trainer plane.

The reviews in the magazine do it justice, except for a noted weak area: The attaching method for the horizontal and vertical stabs wasn't strong enough for me. A simple doubler system was added, and this took care of any doubts I might have had. It's a great airplane for air shows, and the first thing I hear when I visit a new field is "Where can I get one?"!

JAMES C. HORTON, CAPT., USAF
Shaw AFB, SC

(Continued on page 16)

WACO "E"

by DOUGLAS HOBBS

A BIG, BEAUTIFUL SCALE BIPLANE WITH NO COMPLICATED CABANES!

I WAS BORN in 1920, and the first plane I saw was an airborne biplane in 1928. When I was nine, I took my first plane ride—in a biplane; and the first models I built, in 1930, were all biplanes. Biplanes turn me on, and I suppose they always will, because whether in the air or on the ground, no plane looks more majestic than a biplane. I have no technical background in any branch of aviation, but I've always enjoyed building and flying models. I hope you'll enjoy building my Waco "E."

The Fuselage

The fuselage is basically constructed of 1/4x1/4-inch balsa strips. Medium to medium-hard balsa is best, but the softer pieces can be used for the uprights and diagonals. Construction is a little different from that of the usual model in that you build most of the front end first, as a sub-assembly. Cut F-1 from 1/4-inch birch plywood (preferably in one piece, although it may be made from two pieces, if necessary). Cut F-2T and B, and F-3T and B from 1/8-inch lite-ply. Make complete bulkheads by gluing the pieces together, and reinforcing with 1/8x1x1 1/2-inch lite-ply over the joints.

It's very important that the tank compartment top, sides and bottom are accurate in all dimensions and also square. All tank compartment pieces are cut from 1/8-inch lite-ply. Cut F-3B-1 and F-4B-1 from 3/16-inch birch ply, and be sure to include the cutouts to accept the landing-gear wires. To provide extra strength in the landing-gear area, F-3B-2, F-4B-2 and F-4 are cut from 1/8-inch birch ply instead of lite-ply. The forward land-

PHOTOS BY DOUGLAS HOBBS

SPECIFICATIONS

Wingspan: *71 inches, upper wing; 50 inches, lower wing*
Length: *58 inches*
Weight: *9 to 11 pounds*
Wing Area: *1147 square inches*
Wing Loading: *19.0 to 22.1 ounces per square foot*
Power Required: *.60 to .90 2-stroke; .90 4-stroke*
Number of Channels Required: *4*
Materials: *Balsa, poplar and birch ply, fiberglass components*

ing-gear legs are formed from 3/16-inch piano wire; and the aft legs from 5/32-inch piano wire. When bending the wire, leave both aft legs slightly over the required length, as they will later be bent forward to fit the forward legs. Mark the position of F-3B-1 on F-3B, and glue the top piece of F-3B-1 to F-3B with epoxy. Lay the forward gear wire into place, and fit the bottom piece of F-3B-1 tight against the wire and glue with epoxy. Cap this off now with F-3B-2, and fill in around the wire with epoxy. F-4B, F-4B-1 and F-4B-2 are assembled in the same way using the rear landing-gear leg. When the F-4 assembly has thoroughly dried, put the F-4 ply in a vise close to the wire, and bend each leg forward about 50 degrees.

Invert the F-3 assembly and pin it solidly into the building surface over wax paper. Position the tank compartment sides against F-3, aligning them with the 1/8-inch notches in F-3. Now slip F-2 over the sides to the center notches, followed by F-1, which is located by the 1/4-inch notches. Take the top piece and fit it between the two sides. Fit the two engine rails (5/8x5/8x 9 1/4-inch maple) into the assembly, and then fit the floor piece in between the engine rails. Measure to verify that F-1 is accurately positioned in both height and from side to side. When you're sure that this is right, epoxy the parts together, checking on the alignment as you go.

Spot-glue a 7-inch piece of 1/4x1/4 inch at the four corners for protection until you're ready to

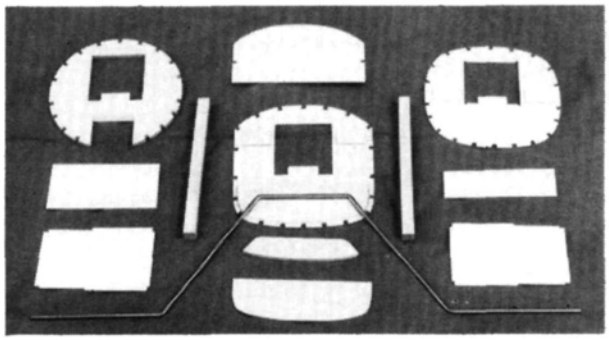
CABIN OR OPEN COCKPIT, WACO BIPLANES WILL BE FLYING INTO THE NEXT CENTURY

Classic Aircraft Corporation, the organization responsible for the reincarnation of the famed Waco YMF-5, achieved a significant milestone in modern aviation history. At its plant in Lansing, MI, Classic rolled out a brand-new Classic Waco YMF-5 biplane bearing registration number N60JG, serial number 19—that's one more than the total number of YMF-5s built by the original Waco company in the mid-'30s.

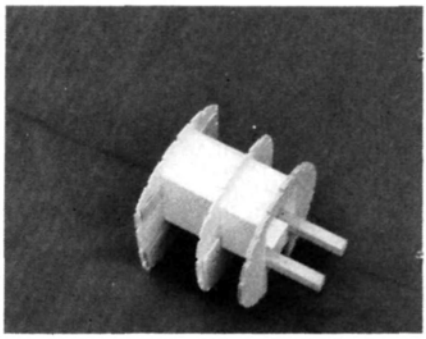
Waco was the most prolific builder of aircraft in the '20s and '30s, turning out nearly twice as many aircraft as its nearest competitor, and somewhat more than 15 percent of the total U.S. aircraft production for those decades. Pilots and observers of the aviation scene have been unanimous that the YMF-5 was the best-looking and best-flying of the many splendid models that the Troy, OH,-based Waco firm designed and marketed. Today, the reincarnated Waco YMF-5 enjoys the same enthusiastic reception.

The Classic Waco YMF-5, after having been out of production for 50 years since 1935, represents the result of authorization to resume production under the original type certificate, with the blessing of the Federal Aviation Administration.

Classic YMF-5s are now being flown by owners in 11 states, and, under the current production schedule of 12 units per year, aircraft watchers may expect the fabric-covered open cockpit biplanes to turn up in almost every part of the country. ■



Parts required to build up the forward "module" to which the individual framework sides will attach. Landing-gear wire is sandwiched to structure.



Front-end parts assembled to form basic Design places fuel tank in near-perfect loca level with engine.

join the sub-assembly to the fuselage sides. (These spot-glued pieces will be removed after attaching the framework sides.) As always, remember that you have to make a right-hand side and a left-hand side, *not two identical sides*. Stringers No. 2 and No. 3, as numbered on the plan, are the only ones built into the side that are full-length. No. 1 only goes to the front side of the windshield side post. The remaining forward stringers, top and bottom, are added after the fuselage has been assembled. Pin stringers Nos. 1, 2 and 3 in place over the plan, followed by the upper and lower wing-saddle pieces. Pin the rear stringers in place, including the 1/4x1/2-inch stabilizer platform. Now fit all vertical pieces and glue them into place. The top piece of the front upright (the windshield side post) should be 1/4x1/4-inch spruce, so you can use small screws (No. 1) to secure the windshield.

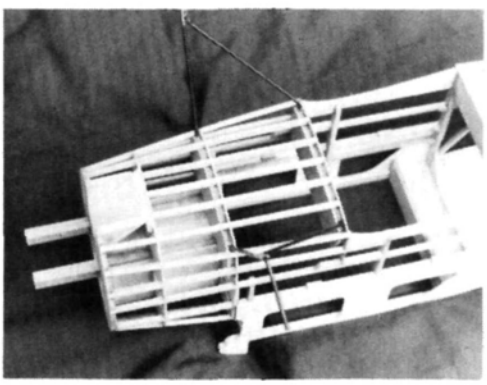
Fit all the diagonal braces and glue them into place. This will be the right-hand side, so while it's still pinned down, glue another piece of 1/4x1/4 inch on top of each of the uprights (exactly the same length as the ones in the frame except for the front one). The piece in the middle of the wing saddle goes to the outer edge of the saddles with the inner edge beveled to 45 degrees. The piece on the front upright goes to the bottom edge of stringer No. 3 to 1/4 inch below the bottom edge of the top wing saddle. To support the balsa sheeting, glue some scrap 1/4x1/4 inch to the bottom edge of stringer No. 2 in the cabin area, as shown on the plan. Add a 1/4x1/4-inch strip to the rear edge of the upright at the rear of the cabin to support the ends of the three 1/8x1/8-inch spruce side fairing strips. Don't add fairing strips until the fuselage has been assembled. When this side is finished and the glue has dried, remove it from the plan and put it aside.

Build the left-hand side in the same way as the one you just finished, but *don't* add the 1/4x1/4-inch doubler strips. When this assembly is complete, remove it from the plan, turn it over, and add the 1/4x1/4-inch doublers. Take the two sides, put their flat surfaces together, and line them up on the two windshield-post uprights; pin them together. Make sure that No. 2 and No. 3 stringers are the same length, and be sure that each side matches the other all around. The tail post must be trimmed inside to provide a taper to 1/8 inch at the rear of the fuselage. Add 1/8-inch sheeting to the outside at the rear of the fuselage, and then add 1/8-inch lite-ply window sections of fuselage sheeting to the outside of the cabin area.

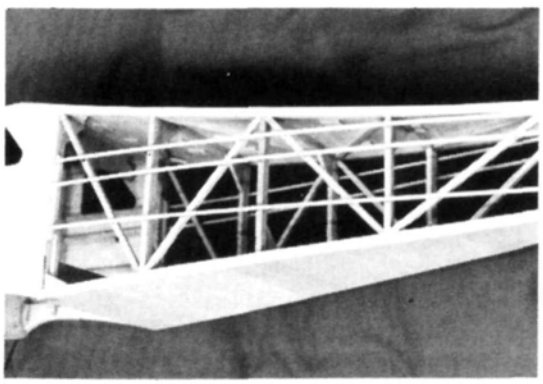
The sides are now ready to be joined to the nose section. Insert the No. 2 and No. 3 stringers into the notches in F-1, F-2 and F-3. Be sure that all the stringers are flush with the face of F-1, then glue them all to F-1, F-2 and F-3. To finish the instrument panel, before you join the sides, glue a piece of 1/8-inch balsa or lite-ply to the back side of F-3. Cut notches for F-1, F-2 and F-3, but *don't* notch for other stringers. This will serve as the instrument panel and the rear wall of the tank compartment.

Next, install the seven top stringers. To keep these stringers straight, you'll have to trim the notches in F-2 in both width and depth. Install F-5T and F-5B with epoxy, along with both 1/4-inch ply wing hold-downs and the F-4B rear gear assembly. Pull the tail posts together and glue these, too. Add the 1/2x1/2-inch tail-post cap.

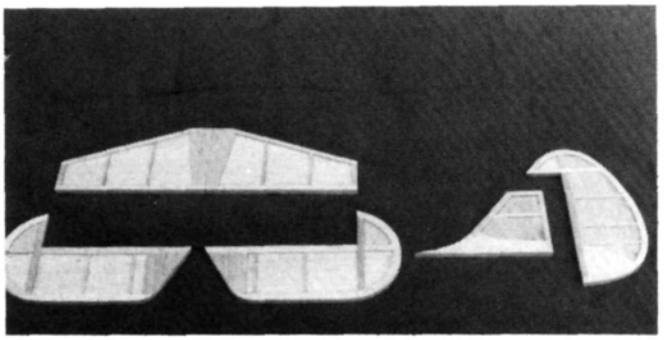
Cut two pieces of 1/4x1/4x5 3/4-inch balsa for the crosspieces for station "C" and glue them into place. (This establishes the



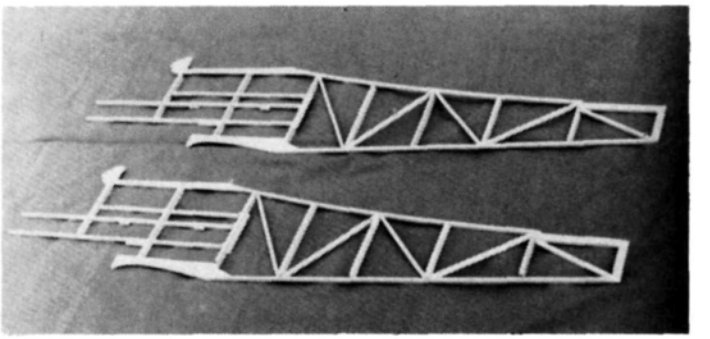
Underside of forward fuselage prior to adding balsa sheeting. Landing-gear installation is rugged. Hot-air outlet duct is built into bottom of fire wall.



Aft fuselage is sheeted on upper and lower surfaces; o structure with stringers on sides. Note use of diagonal b ing and gussets.



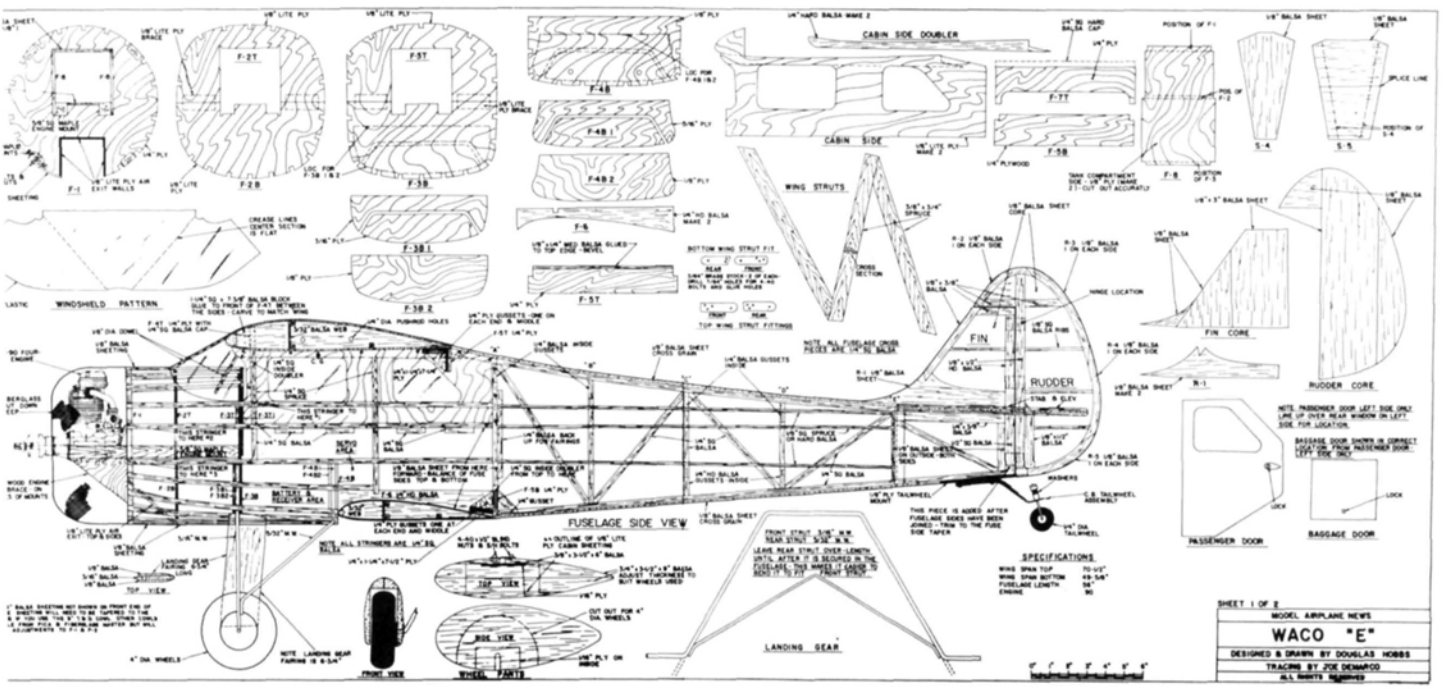
l parts use a balsa center-section core to which framework is added; ps resist warping. Lightening holes not yet added.

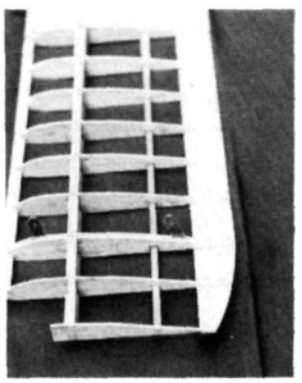


Individual framed fuselage sides are identical, apart from doubler position noted in text. They will attach to forward "module."

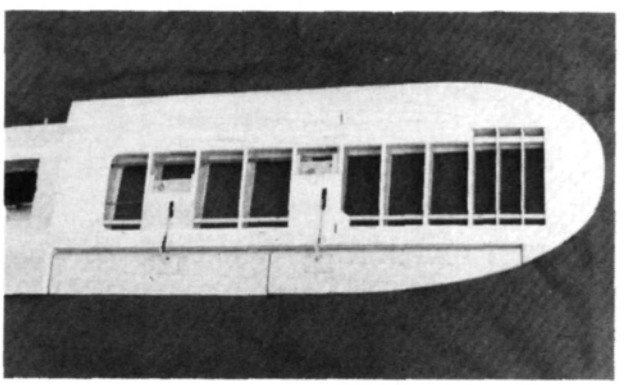
proper curve for the rear fuselage sides.) Measure stations "A-B-D-E" very carefully, top and bottom, for the 1/4x1/4-inch cross-members. Keep it all straight and square. Add gussets in alternate corners to reinforce the upright-to-crosspiece joints. For extra strength, add 1/4x1/4-inch diagonals at the top and at the bottom. Sheet the top and bottom rear with 1/8-inch balsa sheet, allowing the edges to hang 1/8 inch over the sides, and round off the edges. Add the three 1/8x1/8-inch spruce stringers to each side, then sheet the forward sides and the nose with 1/8-inch balsa.

Install the 1/8-inch lite-ply air-exit walls before you sheet the bottom of the nose, and glue the 1/8-inch ply engine-mount

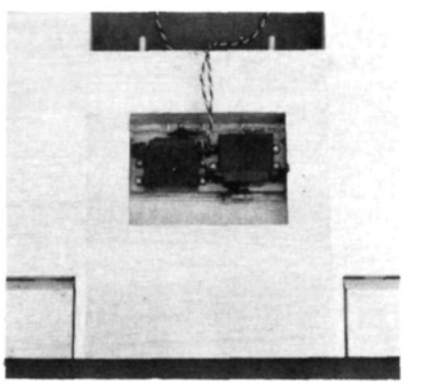




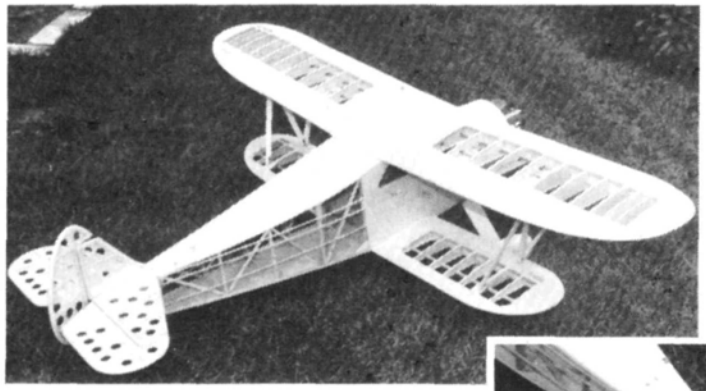
c framework of lower wing r panel awaiting the addition ving tips and leading-edge ting.



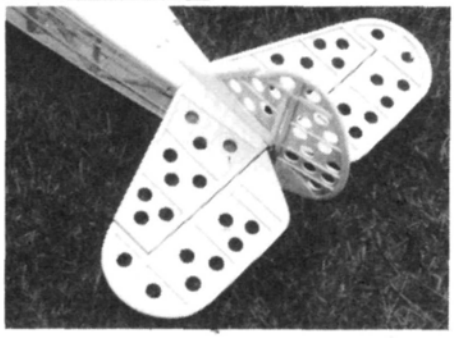
Lower surface of bottom wing with flap and aileron control linkages installed.



Flap and aileron servos are co-located in center section of upper wing. Wire pushrods drive bellcranks connected to control surface.



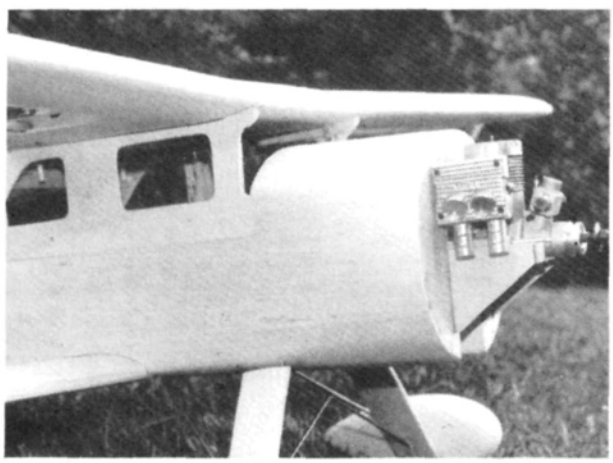
Left: One of the "prettier" moments in the life of any model biplane: straight, beautiful framework ready for covering.



Lightening holes were added to all tail surfaces; found unnecessary with .90 4-stroke engine. Might be a good idea if a lighter .60 2-stroke is used. Reduces the necessity of adding nose weight.

braces with 5-minute epoxy. The 1 1/4x 1 1/4x7 1/2-inch balsa block is glued to the front of F-4T after the top wing has been fitted to the fuselage and the 1/4-inch holes drilled to receive the wing dowels. The landing-gear fairings are made of medium to hard balsa. The 3/16-inch balsa is cut to fit around the wire, as shown, and both sides are capped with 1/8-inch sheet, which allows sanding to the required airfoil shape. Fit the aft landing-gear leg to the forward leg. Add the "shock strut," and bind and solder the wires together with silver solder.For a stronger tail-wheel mount, cut a triangular piece of 3/16-inch or 1/4-inch plywood to fit between the bottom stringers and glue it into place.

The design of the model calls for a 4-inch-deep, 8 1/4-inch-diameter cowl, but I couldn't find one with the right radius on the nose. The 8-inch cowl from T&D Fiberglass* most closely meets my requirements. You can sand the sheeting to taper down to the fire wall, or you can cut the fire wall diameter down to 7 3/4 inches and adjust the stringer notches and sand to F-2. You could also convert to a 4-stroke engine by moving F-1 NAD F-2 rearward to suit the length of the engine used, and then extend the tank compartment into the cabin area.



Cabin area, gear fairings and engine installation are all evident here.

Tail Group

The tail components are all made in the same way: The center core, or base, is 1/8-inch balsa cut to the full outline of each part. Mark the location of the ribs and all outline parts on both sides of each part. All these "frame" pieces are 1/8-inch strips, or are cut from 1/8-inch sheet. To increase the area to which you can fasten the covering material, the center piece on the bottom of the stabilizer is a little wider than the center top piece. Round off all the edges, except the trailing edge of the fin and the stabilizer, which should be left square. For the tie-rod between the two elevator parts, I used a piece of 5/32-inch music wire.

Wing Spars

It's best to build all six spars first. If spruce isn't available, use medium to hard balsa, and build the spars

(Continued on page 65)

Airwaves

(Continued from page 10)

Jim, here's the second thing you should hear: When can MAN expect an article showing our readers just how to duplicate your slick little twin? It resembles a Partenavia P-68, and I'll bet it sounds great with the two 4-strokes! Nice job, let's hear more!

RAU

Wagner's Wondrous Woodworking

You guys just don't stop impressing me! I got interested in R/C last summer and started reading *MAN*. Ever since then, your writers have helped me not only to learn technical information on R/C but also the spirit of it all. The issues dedicated to helicopters, floatplanes, and especially trainers have really shown me the diversity in R/C and raw fun I can have once I get some experience. After researching and reading *MAN*, I bought a trainer. Sure enough, one of the pieces was warped. A few days later, my monthly *MAN* came. I read Joe Wagner's "Building Model Airplanes" column about woodworking techniques, and I managed to get the warp out using his advice. I could have just bought another piece of balsa, but with Joe's advice, I didn't have to. It's the interesting issues and the excellent advice I find in *MAN* that make you guys tops! Keep it up!

MIKE FREIBERGER
Broken Arrow, OK

And some people say we don't talk enough about scratch-building. Thanks Mike, from all of us, and especially Joe W.

RAU

Small Steps Goof!

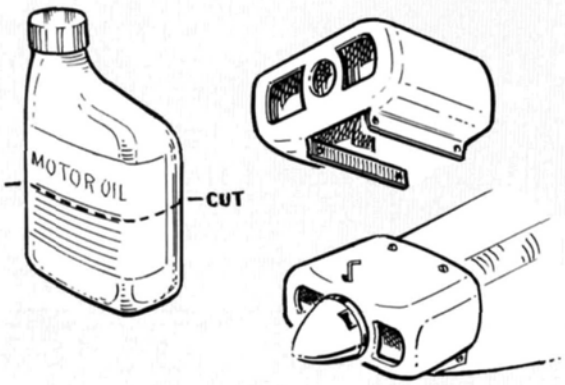
In Joe Wagner's April "Small Steps," on page 120, the message came out that "...Channel 3 doesn't operate the throttle." It should have said, "...Channel 3 will now operate the throttle." We're sure you all had figured that out, though. Our fault, not Joe's!

RAU

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and length.

Hints & Kinks

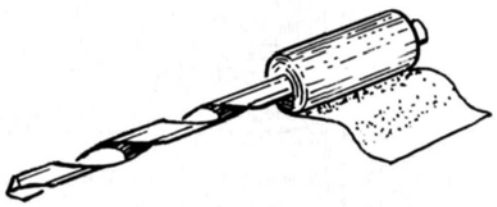
by JIM NEWMAN



READY-MADE COWL

This slick-looking cowl was made from a plastic quart-size motor oil container and, as shown in the photo supplied, it certainly cleaned up the front of a Quick Ray 500. It resembles cowls often seen on some full-size home-built airplanes. The builder claims there are no problems resulting from engine heat.

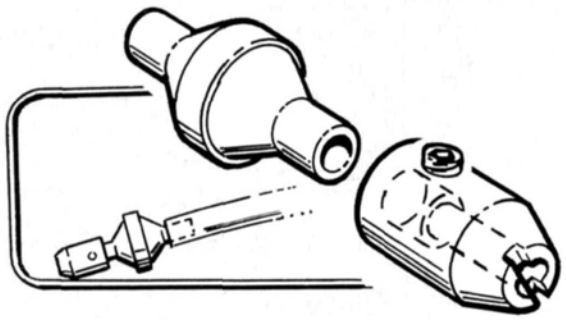
Chuck Sautter, Excelsior, MN



FINGER DRILL

We often resort to twirling miniature drills between finger and thumb, but if we'd stop to wrap a few turns of tape around the drill, it would be easier to hold and we could exert a little more torque.

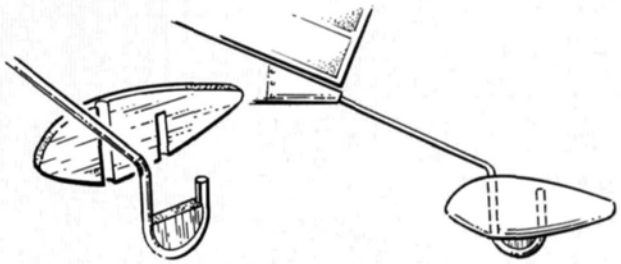
Gene Stubblefield, Memphis, TN



IN-TANK FILTER

When there's insufficient space between the engine and the fire wall do this, drill the clunk weight so that the filter nipple is a tight fit in the hole. Drill and tap the clunk weight for a 2-56 setscrew, and when you press the filter into place, apply a slight smear of silicone sealant for good measure.

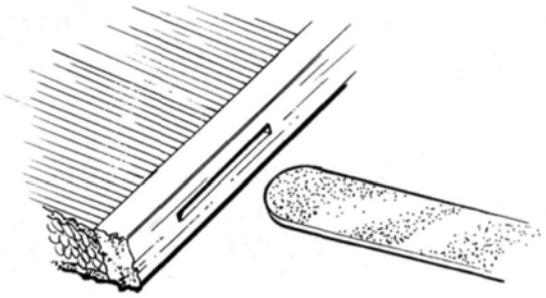
Ed Koporc, Cortland, OH



SLEEK TAILSKID

Bend a U in the wire, then glue a wooden block into the bend, as shown. Sandwich the skid between two halves of a dummy wooden wheel pant, then paint the protruding "wheel" black to look like a tire. Installed at the base of the rudder post, the skid closely resembles the tapered spring-rod tail wheel used on many home-built aircraft.

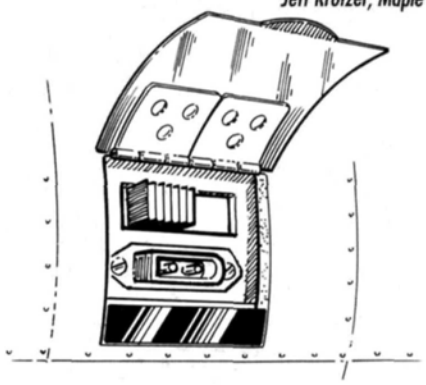
Scott Christensen, Oak Park, IL



BETTER HINGE SLOTS

Pierce the slot in any way you like, then insert an emery board to clean up and provide room for an adequate amount of glue or epoxy.

Jeff Krotzer, Maple Plain, MN

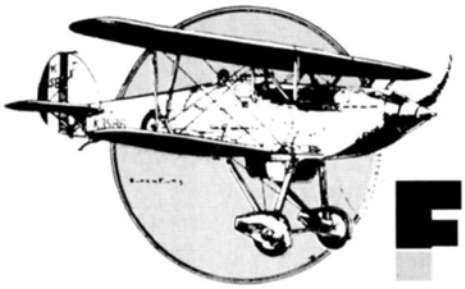


ACCESSORY HATCH

These have been seen here before, but this one's a little different. Cut the door from a piece of tinplate or, as in this case, from a piece of old X-Acto saw, leaving a little bent-up finger tab at the bottom. CA the required number of nylon hinges to the hatch, then glue a strip of magnetic material at the bottom of the opening, flush with the surface. When the hatch is shut, the magnet holds it firm.

Andy Fabian, Portage, IN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News,** 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



Fifty Years Ago

by LYNNE SEWELL

NOT SINCE COLONEL Lindburg's tumultuous reception in 1927 after he'd completed the *first* transatlantic flight had Washington, DC, seen such an enthusiastic horde of cheering well-wishers. The occasion? The very first visit to the USA of a British sovereign—King George VI—on June 7, 1939. However, since the June '39 issue of *MAN* was packed with information and plans for new models, it's doubtful that our readers had any time to spare for listening to the news.

The impressive cover that month showed the German Hamburg Ha. 137 against the oranges and reds of a war-torn sky, and inside, in an article called "The German Devil Gull," Robert McLarren gave info on the plane and provided the plans and details you'd need to build it. First built in 1933, this heavily armed, single-seat, fighter/dive bomber had a deeply inverted gull wing, an open cockpit, an ethylene-glycol cooling radiator, and antenna slung between the fin and two vertical masts mounted just beyond the wing tips. This last feature was thought to be the plane's most outstanding characteristic as, to a large extent, it supposedly eliminated the static-gathering qualities of the wing structure and the hollow tubular spar.

The plans for this plane offered readers something a little different: a new method of making cross-sectional drawings to simplify and increase the accuracy of the fuselage and the wing section. To make templates, readers only had to "cut out the blackened squares" shown on the plans drawing, and for realism, they had to pay special attention to the "tiny cockpit, the antenna posts at the wing tips and the peculiarly shaped rudder."

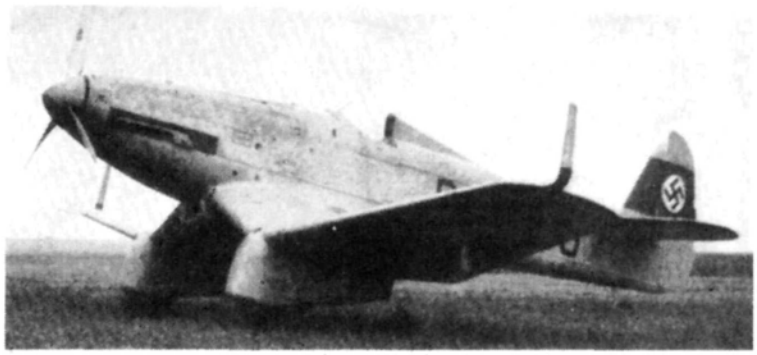
When they'd tested *that* project, modelers could go back to their basements to start on the Dolfin—"an efficient, contest, gas model that flew out of sight in nine minutes."

Unfortunately, on its trial flight before the Texaco Event in Detroit, MI, the Dolfin *disappeared*, so it couldn't be entered. Three days later, when the plane had been given up for lost, a pilot, in response to an ad the Dolfin's owner had placed in the paper, called to say he'd seen the plane from his airplane. After several trips to *many* cornfields, with the airborne caller's help, the plane was found 24 miles from its point of launching. This showed the high lift and high efficiency of this very streamlined plane, but would anyone else have the nerve to build it, when retrieving it cost $9 in gas for the car?!

Inspiration! Where does yours come from? For Herbert K. Weiss, a look a the newspaper was all that was needed. There it was!: the XP-40. The resulting scale model of a high-speed Curtiss pursuit plane was just what he'd been looking for, and the June issue offered a layout that was "considerably more detailed than simpler, past layouts." Powered by two strands of 1/8-inch rubber, the model would fly for at least 25 seconds, but when you'd learned its characteristics, you could try for longer flights.

As if all this wasn't enough to keep modelers basement-bound for the entire summer, Frank Zaic's article on the "Stout Outdoor Record Holder" offered "plans, with complete details of how you can build it." Designed to make full use of thermals, the plane was in the air for 17 minutes, 6.2 seconds to win its title at the 1938 Nationals.

In the regular "Air Ways" column, readers were exhorted to show what they'd been doing all winter and to compete for the "Air Ways Club Trophy," which was to be donated by *Model Airplane News* to the member who made the longest rubber-powered flight. The time to beat was 15 minutes, 45.1 seconds.



The sturdy Hamburg Ha. 137 single-seat fighter. Note the gun ports above the wheels.

The "Gas Lines" column mentioned an idea I know you'll *all* want to copy: A modeler from California wrote to say that his mother had taken up gas modeling, too, and that she took 3rd place in the 1938 California State Championships with her Ohlsson-powered 6-foot-wingspan model. Mrs. Bowers' ship climbed at 944 feet per minute and sported *lace curtains at the window*. She had similarly decked out one of her son's planes, and he said he was being "kidded about it."

The Dolfin: one of the most efficient contest planes ever built.

Can't see why!

I hope all this good reading matter kept modelers' minds busy and off world events—at least for short periods. Although Japan had been bombing China since January 1939, only in June was this trouble in the Far East really brought to the attention of people here. And for many countries in Europe, June began a summer of limbo—of waiting—when they were "more ready for war in peace" than they had ever been.

Here, on June 28, Joe Louis, the World Heavyweight Champ, took on Two-Ton Tony Galento and finished the fight with a KO in the fourth; and the first nylon stockings—which were to be of inestimable value to the U.S. war effort in Europe—were first produced. Why were the stockings so valuable? It's obvious, so I won't offer any prizes.

Hope this issue keeps *you* just as busy as our June '39 issue kept modelers way back then, when TV was still science fiction for ordinary folk, and people had time to stand and stare upwards. ■

DRY-CELL FLIGHT PACKS

Basics of R/C

by RANDY RANDOLPH

A WHILE BACK, I received a call from someone who was having problems with one of my designs. The first part of each flight was fine, but as mild aerobatics began, control response changed and ended flying for the day. A series of calls and suggestions failed to locate the cause of this erratic behavior. Finally, after the plane went completely out of control, the owner discovered that the cold winter weather was reducing the output voltage of his dry-cell battery pack to a non-functioning level! Battery voltage checks done indoors, before and after flying sessions, had failed to indicate the problem. Switching to a Ni-Cd battery pack was the medicine that completely cured the problem.

Two sources of power: dry cells and Ni-Cds. With proper care, dry cells will work in our R/C equipment, but proper care is the secret.

To cut costs in a competitive market, many manufacturers ship radio systems with dry-cell batteries for transmitter and receiver power. Dry cells have different characteristics from Ni-Cd cells in more ways than the ability to be recharged, and these differences are important.

Dry cells have a nominal voltage rating of 1.5V, compared with Ni-Cds, which are rated at 1.2V. This seems to indicate that three dry cells should provide nearly the same voltage as four Ni-Cds, (4.5 vs. 4.8V), but this isn't always true. The internal resistance of a cell is the limiting factor of its ability to supply a large current output without suffering a voltage drop. Dry cells have a higher internal resistance than Ni-Cd cells. This means that under high current demand (e.g., that drawn by a servo in operation against a load), dry cells can show a voltage drop and, near the end of their useful life, this drop could cause equipment failure. However, precautions can be taken (besides not letting them freeze in flight!) that will allow them to be reliable power sources for their usable lives.

Alkaline cells are the only type of dry cell to consider. A new set in a flight pack for a 2- or 3-channel system should provide approximately 5 or 6 hours of dependable flight time before replacement. The trick is to know when their time is up! This can be accomplished in only one sure way: Keep an *accurate* log of all *on* time, and don't cheat on the replacement time! Granted, new cells would run a flashlight longer than 5½ hours and should run a radio receiving system longer, too, but a flashlight costs a lot less than an airplane and won't injure itself (or someone) if one cell fails!

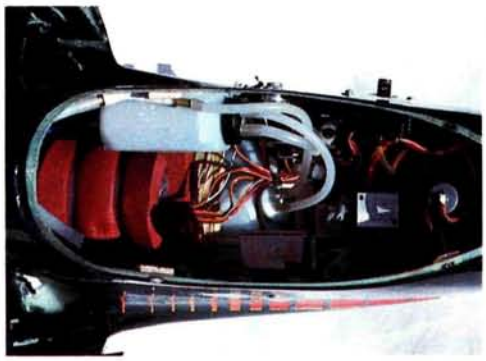
After every flying session, remove the cells from the battery box and their terminals (remove the terminals of the battery box, as well), and clean and polish them with a clean paper towel or cloth. If the box terminals are difficult to reach, use a pencil eraser. Always check the tension of the battery box terminals to ensure that the individual cells maintain good, vibration-proof contact. In the airplane, the battery box should be protected from vibration as much as possible with foam or some other vibration-reducing material. In addition, dry-cell battery boxes aren't recommended for airplanes powered with anything except small engines.

A voltmeter is handy for checking battery voltage, but the battery must be working when it's checked. Simply checking a cell without a load can give a very wrong impression of the cell's ability. Alkaline cells are designed to deliver their rated 1.5V right up to exhaustion before showing much of a voltage drop. (Incidentally, the terms "battery" and "cell" are not interchangeable. A battery is made up of two or more cells!)

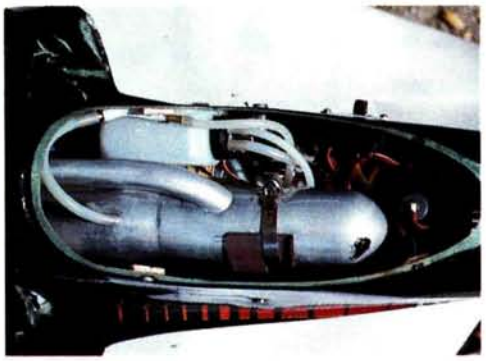
The cells that make up the transmitter battery should provide longer service than those of the flight pack, but they should be replaced every other time the flight pack is replaced. This is especially true if the transmitter doesn't have a visible voltmeter. Dry-cell battery packs may be inexpensive for the manufacturer, but not for the modeler, because each replacement of transmitter and receiver packs is a fair investment, even at discount prices!

By far the least expensive and most reliable way to power a system is with rechargeable Ni-Cd batteries in both transmitter and flight packs. Ni-Cd packs and inexpensive chargers are available from all hobby and mail-order houses. For connecting a flight battery to existing systems, the reliable Nobel switches and Deans connectors are the quality standard of the industry and are available in most hobby shops. *Don't* use department store Ni-Cds as replacements for alkaline cells in battery boxes: Only Ni-Cd cells with solder tabs should be used, and all connections to the cells, switch and connectors must be soldered *correctly*.

Alkaline cells will provide power for our systems, but they must be treated with respect and given the proper care to deliver the dependability R/C systems require. That's basic! ■



Things can get a little crowded below the canopy, especially when the very effective "chicken hopper" tank is added. It improves fuel delivery during maneuvering.



Since the Cloud Dancer modifications include rotating the engine to an upright position, some of the cockpit area is now occupied by the tuned pipe.

The pipe is now housed underneath the tinted canopy, with cooling air supplied through the nose-wheel opening, flowing above the nose-gear bulkhead.

CLOUD DANCER BYRON BULLET MODIFICATIONS

GETTING SHOW-TYPE PERFORMANCE AND RELIABILITY FROM YOUR SPORT JET

by DON MUDDIMAN

HI! MY NAME is Don Muddiman and I'm a member of the Cloud Dancers International Show Team.* We've been asked many times about the modifications that have been made to our Byron* Bullet aircraft and the reasons for the changes. Before I tell you the reasons, I'll give you some background information on the team's members.

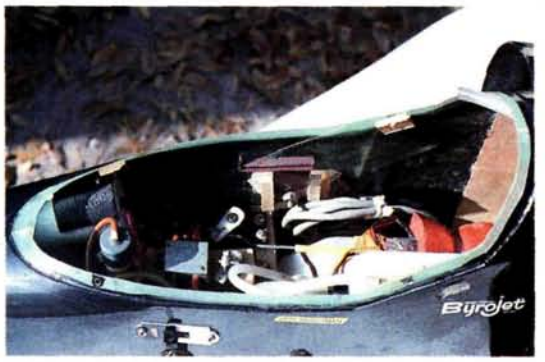
Dale Nalley is the newest member of the show team, and he has been a member for four years. Professionally, Dale is a master craftsman in fiberglass, mold-making, composites and painting. Is it any wonder he works for Composite Craft! I remember one of the first trips he took with us. We picked him up on a Friday night on the way to a fan-fly in Texas. A few miles down the road, he asked, "By the way, where are we going anyway?" With all the excitement of his first show-team trip, he never thought to ask where we were going until we were on the road!

Next, John Davis, who's the guy one of our sponsors says looks either as though he's mad all the time or as happy as he can be. There's no in-between. (Just kidding, John!) A machinist for Martin Marietta Missile Systems, John has been a show-team member for eight years. John's dad is also a machinist, and he has his own shop at home, so that's where you'll find John most of the time—making adaptors and the likes for our aircraft.

Tom (Tommy) Veloskey Jr., has been a team member since day one. A student working toward a degree in aeronautical engineering, he flies the lead aircraft in the for-

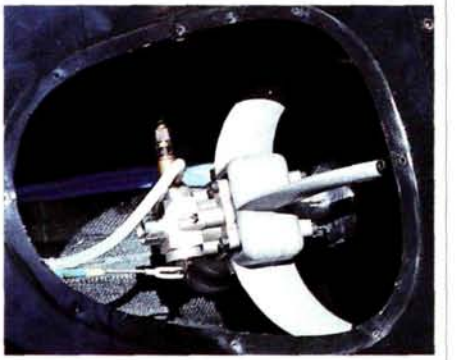
PHOTO BY DON MUDDIMAN

Above: The Sky Riders demo team uses similar vertical fin and rudder modifications to their Bullet models.
Left: One of the Cloud Dancers' demonstration Bullets. This one retains the stock vertical fin and hinge line. Colorful paint scheme gets the crowd's attention.



This view of the right side of the cockpit area has most of the components, like the servos and retract spool valve, positioned per the manufacturer's recommendation.

As can be seen here, the stock Bullet fin was replaced by a Bullet horizontal stabilizer assembly. The rudder was cut from the assembly and hinged on a line perpendicular to the root.



View through the lower fuselage access hole shows that the fan unit and engine have been rotated upright.

mation and calls the maneuvers. Tommy is also our jump-plane pilot, and we just wait for him to screw up so that we can say, "He went to college to learn that."

Tom Veloskey Sr., is the "old man" of the group, and is another founding member, so his favorite excuse for anything is it has been like that "since day one." Tom also works for Martin Marietta Missile Systems in none other than the Model Shop. In the past, he has been an auto mechanic, a boat driver and mechanic, and a body shop manager and service manager. But Tom's specialty is art, and he's the one who does our color schemes and designs for our aircraft. The great thing about this is that when you need new markings for your aircraft, you just give it to Tom and presto!—you have a new scheme *free of charge*. I don't know how Tom stays calm when putting identical markings on as many as five aircraft. I'd go crazy!

Now it's my turn: I also work for Martin Marietta Missile Systems. (Did you hear an echo?) I've been an auto mechanic, a boat driver and mechanic, a craftsman working with composites, and I now operate a scanning electron microscope in failure analysis. I examine failed parts at high magnification (100 to 50,000x) to figure out why they failed. I've also been with the team since—you guessed it!—day one. My duties include being the wing man in the formation routine and performing the solo act with The Flying Machine, which is an aircraft I designed.

The performance that brings all the team members together is Skydiving—a display in which all except Tommy (the jump-plane pilot) control their own R/C skydiver. Tom Sr. and I designed the skydivers 10 years ago.

Each one of us plays an important part in the show team, and our success is due not only to our combined talents but also to our friendship. In fact, I think the *major* reason for the success of our team is this friendship.

The Secrets of Our Success

The biggest secret is that there are no secrets in what we do. Living in Florida is obviously a great help, as we can fly during about 90 percent of the year, and this adds up to a lot of stick time. You get to know your aircraft *very* well.

Our review kit, featured in our April "Jet" issue, retained the original configuration fin and rudder, but added a dorsal fin, both for cosmetics and to provide additional fin stiffness by increasing the attachment area of the fin to the fuselage.

To maintain the aircraft for show performance, we have one main rule: Keep it as simple and maintenance-free as possible. This isn't always easy, but we think that the simpler it is, the fewer problems we'll have. Don't take me wrong! The items provided in the kits we fly work, and work *well*. Take, for example, the Byron Bullet. A good, sport, ducted-fan jet, the aircraft has an excellent speed envelope, its price is relatively low for a ducted fan, it's easily assembled and it's very maneuverable. However, to make it a show-team aircraft, we though a few things could be improved.

• The first modification we made was to install the engine upright. This provides easy access to the glow plug, it helps prevent flooding, and it provides better cooling for the tuned pipe. Air flow comes up through the nose-wheel well into the canopy, where the tuned pipe is now mounted. This modification required several other mods to make it work. If you use an O.S. .77, you must mill 1/8 inch off the cooling fins on the engine's head to

(Continued on page 81)

Scratch-built, radial-powered with on-board ignition. The ultimate in R/C biplane realism?

PROJECT PT-17

by NICK ZIROLI

THE PT-17 STEARMAN was the most effective pilot trainer of the the last World War, and is often referred to as "the Jenny of WW II." It *must* have been good: it gave thousands of pilots their wings! The PT-17 has the rugged looks of a good trainer: They say you couldn't break it in the air, no matter how hard you tried. Its functional good looks have always made it a popular airplane, and, as there are many attractive military and civilian color schemes to duplicate, it's a natural as a modeling subject. The PT-17 has also been a popular aerobatic show plane, especially with increased power and additional ailerons in the top wing to make it more maneuverable. Nearly every air show hosts a few colorful Stearmans.

PHOTOS BY RICH URAVITCH

Close-up of gear leg shows use of Robart PT-17 strut, which features functioning "nutcracker" scissors. Has application to many other types.

The earliest model version that I recall (and eventually built) was a control-line replica of Sammy Mason's orange and white, 450hp show plane. *Air Trails Pictorial* published the plans in its April 1950 issue. It was designed by J.C. "Madman" Yates, one of the control-line stunt greats. Bob Palmer, another well-known designer, built the model and, with Yates doing the flying, they won the control-line scale event as a team entry at the 1948 Olathe, Kansas Nationals.

Over the years, the PT-17 has always been a popular subject and has been available in a number of sizes. For about 20 years, Sterling Models* has produced a 1/6-scale, 64 1/2-inch-wingspan kit. Royal's* broad line of scale kits now includes a 68-inch-span version of the PT-17. For giant-scale scratch-builders, 1/4-scale, 96-inch-wingspan plans are available from Don Godfrey and Barron's Plan Service. Barron also offers a 1/6-scale version. Mine is 1/5 scale, with a 77-inch span, and I have a plan set available*. I designed it to be powered by a Quadra 35-40 or a Zenoah 38.

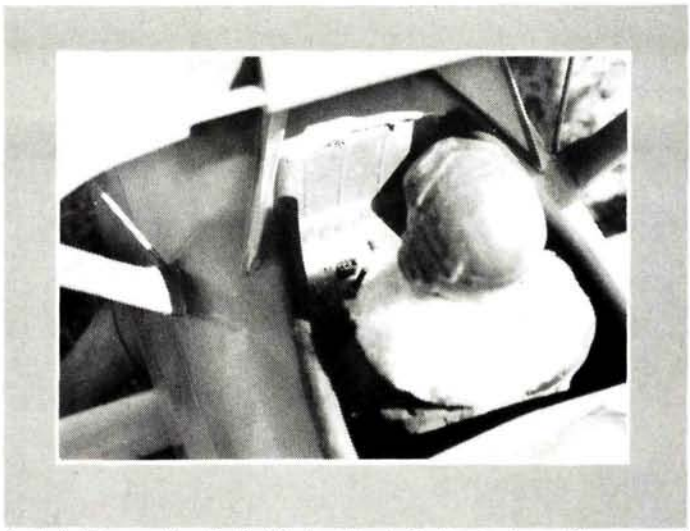
Construction of this PT-17 is very conventional, except perhaps for the technique employed for the

The O.S. radial was mounted directly to the fire wall rather than to the supplied ring mount, which would have positioned the engine too far forward.

fuselage, which is built around a flat crutch frame, and the forward section is made of poplar plywood. Plywood formers, stringers and sheet balsa in the metal-covered areas complete the fuselage structure. Wings and tail surfaces are standard procedure. To cover the PT-17, I prefer to use Super Coverite*. Coverite is one of the oldest covering materials, and still the best I've used. I covered the fuselage with one piece of material, brushed on one coat of clear nitrate dope, and, to complete the finish, I sprayed on auto acrylic lacquer. To simulate painted sheet metal, I masked around the metal-covered areas and filled the fabric weave with primer before the color was applied.

The plan shows an aluminum (or more scale-like wire) landing gear assembly. I was content with the sheet aluminum gear, although I really didn't care for its appearance. When Bob Walker of Robart* saw my PT-17, he asked why I didn't have Robart's scale strut assemblies on my plane. Since I'd never seen this item in any of Robart's literature, I didn't know it existed. Bob had received so many requests for an

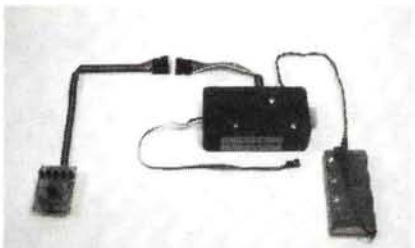
PT-17



Just visible over the pilot's left shoulder is the "control panel" portion of the McDaniel ignition system. Four of the five LEDs can be seen, along with the charge connector and on/off switch.

operating oleo strut for the Royal PT-17 that he designed and built some units. These will fit my PT-17 as well, and Robart includes an installation drawing for them. They're a nice addition to any Stearman from 1/6 to 1/5 scale.

While I was digging into the bottom of my PT-17 to retrofit the Robart struts (not a difficult task), another modification became absolutely necessary. Rich Uravitch had an O.S. FR5-300 5-cylinder radial engine from Tower Hobbies* that he wanted to check out. He thought it would make a nice addition to my PT-17, and that any airplane with two wings should have a round engine. Shows you how wrong some people can be! Can you imagine a DH-82 Tiger Moth with a radial engine? It just wouldn't look right. How about an Albatros, an S.E.5, a Curtiss P-6E or, of more recent vintage, a Pitts Special? These are only a few of many good-looking bipes with straight or flat engines. I must agree with Rich, though, that *many* of the best-looking biplanes have round engines.



Here are all the component pieces of the McDaniel on-board ignition system used in Project PT-17. Multiple cylinder relibility is greatly enhanced by keeping the plugs hot when necessary.

Radial engines aren't new to modelers. The oldest commercially available 5-cylinder was the Morton/Burgess M-5 of the '40s. This was a good-looking, but not very practical, replica of the LeBlond engine. It was rather small (less than a .60) and not very powerful. I doubt that many actually flew a model. I recall that Lou Proctor flew his prototype Antic with one. Today, this engine is a much-desired collector's item.

The new generation of multi-cylinder, 4-stroke engines are definitely not toys: They're highly engineered, precision-made powerplants meant to be flown, not to reside under glass in a collection, although many will. Four-stroke technology has made giant advances in recent years. I bought one of the earliest O.S. 60 4-stroke engines when they first became available. It was an intriguing engine, but not one of O.S.'s best, because it wasn't dependable. Technical improvements and competition followed, quickly bringing the 4-stroke engine from a curiosity piece to a practical engine.

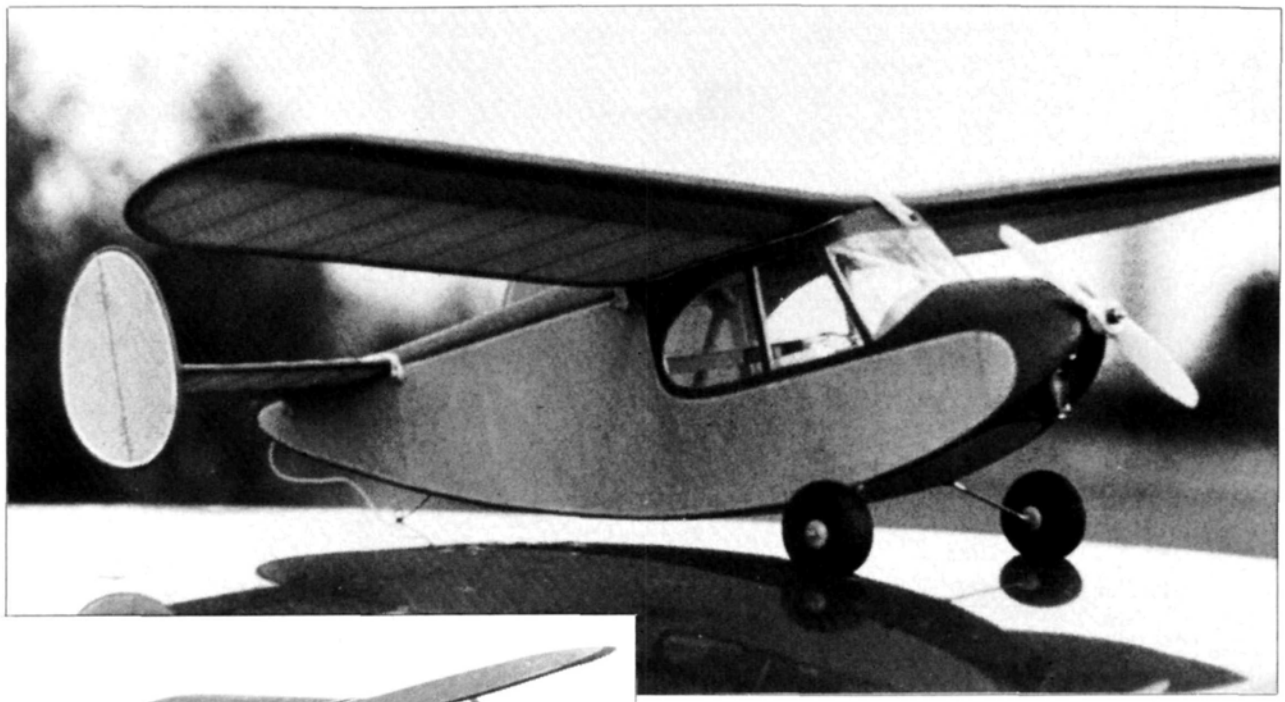
As with every O.S. engine I've ever operated, including the early .60, the radial is a masterpiece in both operation and appearance. It resembles the Kinner 5-cylinder radial used in the '30s and the early '40s. O.S. has been in the forefront of multi-cylinder development, with its opposed 2-, 4- and the 5-cylinder FR5-300s. The larger 4-stroke engines, especially the multi-cylinders, operate much more smoothly than their chain-saw counterparts, and this makes for longer-lasting radio equipment and airplanes.

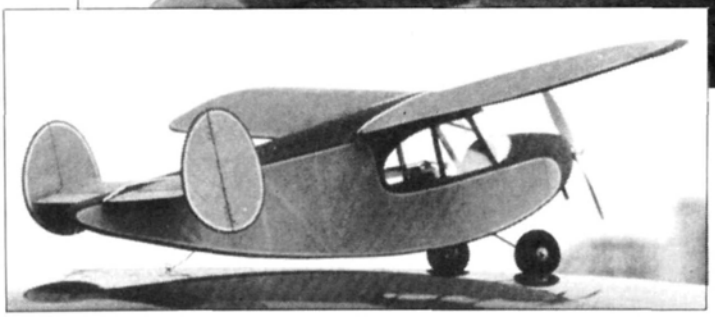
I'd been flying my 19-pound Stearman with a Quadra 35 for almost two years and

(Continued on page 82)

Small Steps

by JOE WAGNER





Above: The jaunty lines of the Twin Lizzie are typical of Keith Laumer's many sport-flying designs. They all flew as well as they looked, too!

Left: Spanning a mere 31 inches, this Twin Lizzie built by Swedish modeler Tomas Hultgren has been beautifully adapted for R/C from its original free-flight design (published in MAN, April '59).

IN THE PAST few months, several readers of this column have written to ask about the practicality of converting rubber-powered model kits, e.g., Comet, Sterling, or Guillow models, to R/C. After all, right on the beautiful full-color boxes of most of these kits, you'll see the claim, "Easy Conversion to Control-Line or R/C Flying." Many attractive types are available in this line of scale models, too: the Lockheed P-38, the Focke-Wulf 190, the Sopwith Camel, the Grumman Hellcat and the Boeing Flying Fortress.

It seems a shame, but I just have to tell the modelers who ask about these "conversion projects" that I don't recommend them at all. For one thing, most of the scale-type kits manufactured by Guillow, i.e. the Comet, etc., weren't really designed for flying, but are primarily for display. They were meant to be easily assembled by those with little modeling experience, and their structures are far too heavy for successful rubber-powered flight and too flimsy for R/C. Most employ a type of construction that's totally unsuitable for R/C system installation, and trying to gain access to their interiors to install the radio receiver, the battery and the servos would be a nightmare.

Comet makes a couple of big lightplane kits that are well-designed for flight: a 54-inch-span model of the Aeronca Chief and the 1946 Taylorcraft. However, since these are intended for rubber power, their construction has to be extremely light to ensure good performance, and they aren't nearly rugged enough for either gas- or electric-powered R/C. Converting these 54-inch Comet lightplanes for R/C would necessitate discarding everything in the kit boxes except the plans—and even those would need substantial revision for a practical R/C version.

If you're looking for some good, scale, model kits that are suitable for schoolyard-style R/C flying, try Flyline* products. The company has a Curtiss Robin, a Bucker Jungmeister, Lindbergh's Ryan Spirit of St. Louis, the low-wing Kinner Sportster and an almost 4-foot-span Megowcoupe among its small R/C kit designs. All have lightweight, but sturdy, built-up construction, and the wood in the kits is carefully and skillfully chosen. Flyline also makes a cute little half-size Quaker Flash old-timer, which is ideal for Cox*

Pee Wee power and a Cannon* Micro R/C system. With one of these, you can fly from a space as small as a baseball diamond.

Speaking of flying off small fields (as Randy and I have been doing for many years) it's always best to be as sure as possible that no other R/C model is flying within, say, a 3-mile radius. It's easy enough to find out if there's an R/C model club field in your area (the people at the nearest hobby shop will know), but you can never be certain that some independent flier isn't R/C'ing from a nearby

Beneath Flyline's Plain Jane box covers are some excellent scale-model R/C airplane kits that are truly designed to FLY.

Though it might say "Easily convertible to R/C" on its box label, a "rubber model" kit of the sort shown here is a very poor prospect for successful radio control.

school yard. After all, lots of low-cost ARF models (such as the Cox E-Z Bee) are now sold, and some are surely bought by inexperienced people who might not realize the possibility of causing—or suffering from—radio interference.

Thus, if you plan to do much R/C flying from a local field, scout around the general area to see whether, within about 3 miles, there are any other open spaces that someone might be using as a flying field. If so, ask those who live in that neighborhood if they've ever seen any R/C models flying there. If they have, you could find out when they're usually flown; pay a visit to the field then, and make friends with the other flier. He probably won't be on your frequency, but if he is, it will be easy to make arrangements to avoid any possibility of interference.

There's always the chance of some newcomer going out with his brand-new ARF to a field just down the road from where you're flying, but the odds are against any interference. Even assuming you're both on the same frequency, a rank beginner is likely to crash rather promptly, so his radio transmissions won't last long. In any case, there isn't a lot you can do to protect yourself from "independent flier" interference. You could turn on your receiver and hold your airplane at arm's length overhead for 5 minutes or so to check for interfering signals, but that test can't guarantee that someone a mile or so away won't turn on his transmitter while your airplane is high in the sky!

That's another excellent reason for having a small, lightweight, R/C airplane with limited power. With one of these, if something does go amiss, there's little likelihood of serious property damage or personal injury.

Plane Pics

Here's some good news for "Small Steps" readers who'd like to see pictures of their models in this column: Now I can convert color prints to black-and-white photos for publication. The only requirements are that your prints have a sharp focus (any size will do) on *glossy* paper, and that there's good contrast between light and dark.

I'm using two such converted-from-color pictures with this month's column. The airplane shown is yellow with dark green trim, and it was photographed on top of a car roof against a pale blue cloudy sky. As you can see, this color scheme reproduced exceptionally well in black and white, and the dark-to-light contrast range is excellent. I could use a lot more good model photos like this!

As for the model itself, it was built by Tomas Hultgren of Stockholm, Sweden. The design is Keith Kaumer's Twin Lizzie, which was featured in the April '59 issue of *MAN*. This airplane was designed as a 1/2A-powered, sport, free-flighter—a type of model in which Keith Laumer specialized. No less than 18 of his excellent miniature-model designs were published in various model magazines between 1957 and 1963. (In the mid '60s, Keith seemed to abandon model airplanes in favor of science fiction writing, and his books are every bit as good as his airplane designs. His "Retief" stories are among

(Continued on page 91)

Quiet Flight

by JOHN LUPPERGER

ONE OF THE most disruptive things that can happen to a modeler is having to move from one house to another. I've just gone through the process, and my life is a total wreck! It looks as though it will be *weeks* before I'll be able to resume normal modeling activity. I find it difficult to understand how it's possible to move to a *larger* house and run out of space! I actually think things multiplied during the move.

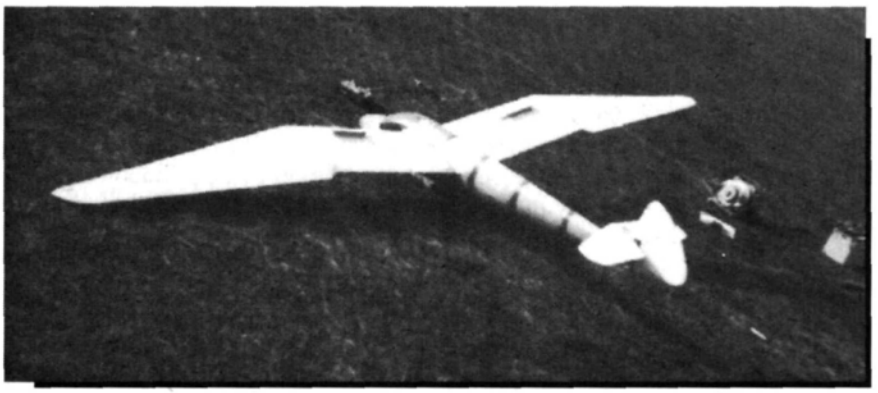
Great Graphics

Did you ever wonder how off-road racers manage to have such great-looking graphics? I don't mean R/C cars; I'm talking full-scale. It seemed to me that it would be awfully expensive to touch-up or repaint those graphics after every race, but recently, I found out how they keep those cars looking so good.

Gary Brokaw and the "Mini" get ready for the first flight. Gary reports that the 1/4-scale, 166-inch span model is a real pussycat to fly.

Many of the graphics that I had thought were painted on are actually vinyl stick-ons, and a company called Mr. Sticker* makes these graphics—not only the lettering, but also many of the sponsor stickers. The company makes letters in sizes ranging from 1/4 inch to 12 1/2 inches, and they can be ordered in almost any font style and color. Even custom art work can be digitized for easy reproduction. A typical 2-inch AMA number costs about $5.

If you're like a lot of people, when you finish a new model and it's time to put on your AMA numbers, something happens. The model looks great, but no matter how carefully you cut out and apply the letters, they look like heck. As a matter of fact, you don't even bother trying anymore. I know this is true, because I see very few models with AMA numbers. However, now that I've found Mr. Sticker, all of my models will be adorned with great-looking numbers. Drop the company a line to request a complete price list, and don't forget to tell them you heard about their product in *Model Airplane News*.



Gary Brokaw's Minimoa just prior to its first ROG takeoff. Compare size of model to the transmitter and winch to get a feeling of how big the Minimoa is!

Plans Service Minimoa

A few issues back, I ran some pictures of Gary Brokaw's* unfinished Minimoa, which he'd built from plans bought from J.M. Lupperger Plans*. Gary recently finished construction on the Minimoa, and he sent some pictures and a flying report. I'll let Gary take over:

"Enclosed are some pictures of my recently completed 1/4-scale Minimoa. Although I hadn't painted the airplane, I couldn't wait to fly it. It made its maiden flight during the last weekend in January, and it couldn't have been more perfect. I had never seen a Minimoa fly, so I didn't know what to expect. The 'helpful advice' received along the way added to my first-flight jitters: 'The rudder looks too small, the ailerons are too big, and the airfoil is *way* too thick.' With all this good advice stored in my head, I was expecting the worst, but still hoping for the best. After checking out all the controls and the radio, I was ready—well, as ready as I'd ever be—for the Mini's first skyward ride.

"Two friends hooked-up the Mini to the winch and aimed the massive glider into a light breeze for its first ROG takeoff. My shaking foot stomped on the winch peddle, and the 14-pounder started to gain speed. It became airborne in about 20 feet, climbing straight out, just like a Gentle Lady, with virtually no help from my nervous thumbs. At about 400 feet, I freed it from the winch line and it became one of the most majestic, easy-flying sailplanes I've ever placed my hands on! The massive wing carried the weight so well that I'm very tempted to enter this monster in one of our thermal duration contests. I'm not sure it would win, but I know who would have the most fun!

"After over 4 minutes in the air, it was time to land (in the cold January air of

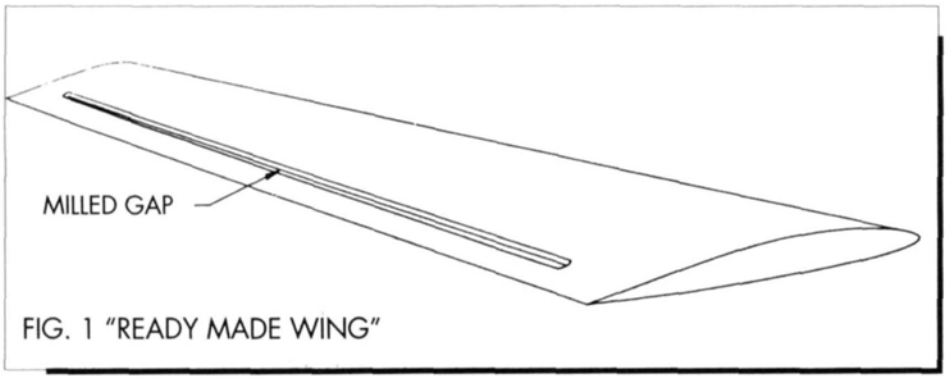


FIG. 1 "READY MADE WING"

Spokane, WA, thermals are basically nonexistent!). The spoilers did a perfect job of setting the plane down right where I wanted. The Minimoa rolled to a scale-like stop, and all present—including me—let out a yell of approval. On subsequent flights, I passed the transmitter around, and everyone commented on how easily it flew; in fact, it flies so easily that it's difficult to believe it's scale and not some poly floater.

"The plans, which are imported from England, were very well done, with one exception: The outer panel ribs didn't seem to work for me (probably my fault, though), so I cut a second set, and this wasn't a big deal at all. The fuselage in the cockpit area also turned out to be a challenge, but I was very happy with the results.

"I did make one change: I increased the spar size and used a 3/8-inch wing rod instead of the proposed wing blades. The original was flown off slopes, but I wanted to be able to winch-launch mine, and everything works well with a tow hook on the spar under each wing.

"After scratch-building an airplane, you really have a new appreciation for the world of kit manufacturing. Kits are really much bigger bargains than I had ever imagined.

"If anyone would like to talk about the Mini, I'd be happy to talk to them."

I've included Gary's address and phone number at the end of this article. His comments on how easy the Minimoa is to fly are very interesting. I think a lot of modelers shy away from scale models because they automatically assume they'll be difficult to fly. The older-style vintage gliders usually have thick airfoils and fly quite slowly. They can be flown from a winch as well as from a slope, and, although they tend to involve a lot of building, the end result is always well worth the effort.

Foam Wing Hinges

There are probably as many ways to hinge a control surface as there are commercially available hinges. However, A.M. Zimmermann of South Africa has come up with a method that works without the use of conventional hinges. I'll let Mr. Zimmermann explain:

"I've been an avid model builder and flier since 1975, and although I started rather late in life, this hobby has always fascinated me. I read *MAN* with great interest (when available!—there's a shortage of magazines in our country, and subscriptions aren't always possible), and I always find very good hints on improving and/or simplifying model building.

"My particular interest is in scale glider models, and I'm fortunate enough to possess a DG 300, a Speed Astir, a Twin Astir, an Astir CS 77 and a Calif A 14. The last one is my favorite model, and, with a 4.2-meter wingspan, it's an excellent soarer. I've tried to make exact replicas of the full-size aircraft, and I'm constantly striving to improve details.

"One of the details that bothers me is the fastening procedure of ailerons, flaps, elevator fin, etc., with hinges, adhesive tape and other ready-made fittings. I've

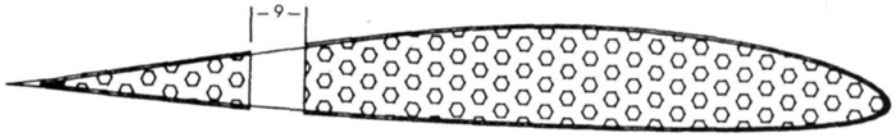


FIG. 2 SECTION OF WING

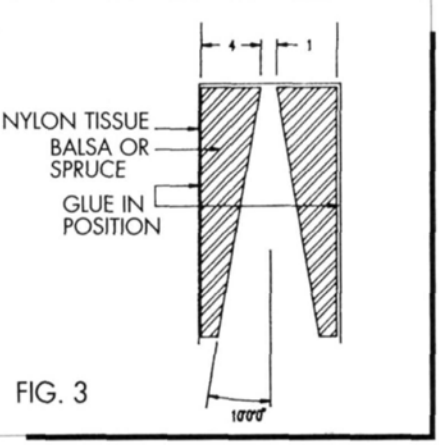


FIG. 3

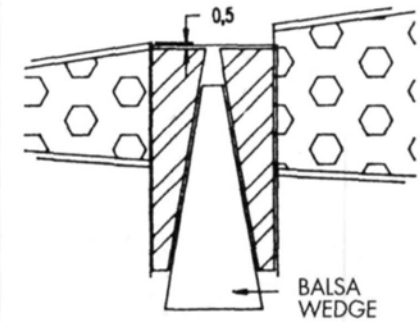


FIG. 4

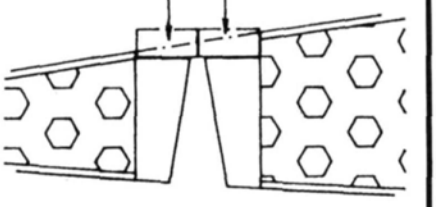


FIG. 6

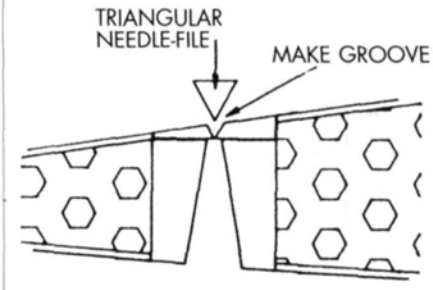


FIG. 7

devised a system to overcome this, and it has worked most successfully with my Calif A 14.

"The foam wings and elevator that come from the manufacturer are covered with 0.5mm-thick plywood. The control surfaces have milled-out gaps that make working easier, but not ideal (Fig. 1). My system is as follows:

"Mill a 9mm gap on the full length of the control surfaces of a foam wing. (Fig. 2). Take two pieces of hard balsa or spruce, 4mm thick by the length of the control surface and at least two-thirds wider than the depth of the groover. Plane or sand the angle as required. To move the control surface, I found that 10 degrees on each side (giving 20 degrees of total angle) is adequate. Then, leaving a gap of approximately 1mm between the two strips, glue a non-stretch, thin, nylon tissue into position using CA, or any 'rapid' glue (Fig. 3).

"Insert the 'hinge' in the gap between the main body and the control surface, leaving a gap of at least .5mm from the top surface. Glue into position, using epoxy or a similar glue, using wedges of 20-degree angles (Fig. 4). Sand flush at the underside. Glue a 2x4.5mm balsa strip on top of the hinge and fill any gaps (Fig. 5). To achieve a nice, smooth finish, use a triangular file, but *file carefully* (Fig. 6).

"Make a groove, ensuring that the nylon tissue isn't damaged. Cut both ends of the control surface with a thin blade (reducing an unnecessary large gap). Slowly move the control surface up and down, and, with a scalpel, remove the excess glue between the wooden strips—again taking care not to damage the nylon tissue (Fig. 7).

"After sanding, painting, or covering the surfaces, cover the gap with a self-adhesive weatherstrip that's commercially available in black or white (Fig. 8). The result is neat and clean."

It looks as though Mr. Zimmermann's hinge idea would work very well and could be applied to non-scale models as well. If you have a neat idea, or a different approach to an old problem, send it to me, and I'll share it with our readers.

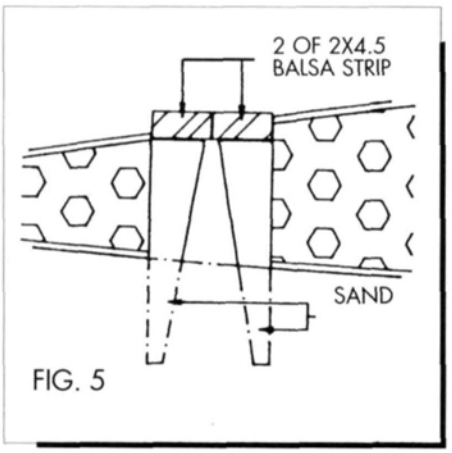


FIG. 5

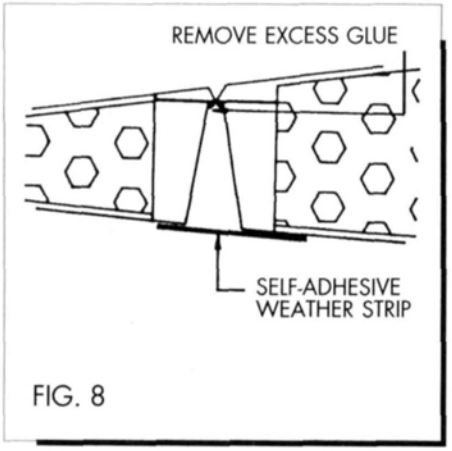
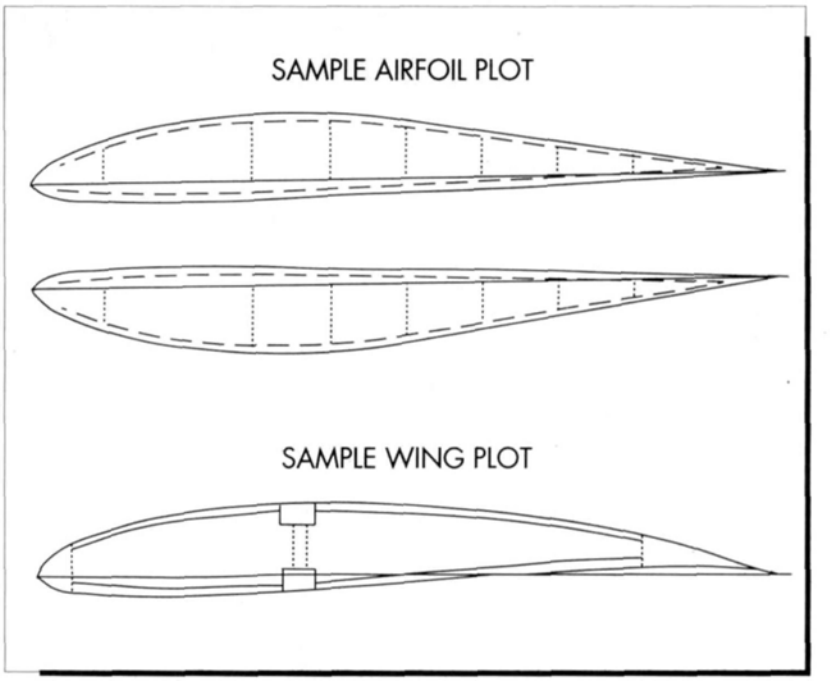


FIG. 8



Here's the correct drawing created by the "Airfoil Plot" program available from Chuck Anderson. We messed up the one presented in our March issue. Sorry!

More Computer Software

A few issues back, I presented information on Chuck Anderson's Airfoil and Wing Design Programs. Somehow, the drawings presented in that issue were slightly screwed up, so here are the examples of Chuck's program as they *should* have looked. Apologies to Chuck.

Chuck has been at it again, and he has worked up some mods and some new programs for personal computers. He has added a routine that allows you to plot the actual wing planform, circles, ellipses and combinations of these figures. This isn't a CAD program, but an aid to those modelers who don't have drafting equipment. The program is designed to work with IBM and IBM-compatible computers, and it will be available by the time you read this. The new program contains these mods and Chuck's original programs. (Cost: $40, including postage and handling.)

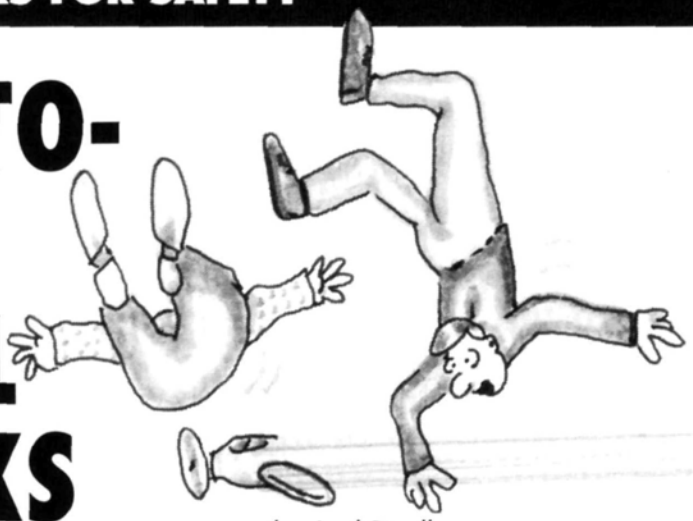
The design program consists of three options for plotting ribs and planforms for wings with up to nine spars, as well as for plotting the leading and trailing edges. This program also allows for transition from one airfoil section to another over the wingspan, and it will incorporate up to 5 degrees of washout over the span. SPEC is used to input the airfoils, dimensions, sweep angles, spars and other plot criteria. The data is then saved to disc for use by the PLOT and PLAN options. PLOT is used to plot rigs specified in the SPEC file, while PLAN draws full-scale and reduced-scale plans of the wing.

This program should prove very helpful to those who wish to design their own super ship. If this sounds interesting to you, contact Chuck Anderson.* Don't forget to tell him you saw it in *Model Airplane News*.

Till next time...good thermals and a full charge!

**Here are the addresses that are pertinent to this article:*
Mr. Sticker, *18081 Redondo Circle, Suite E. Huntington Beach, CA 92648.*
Gary Brokaw, *2615 South Cherry, Spokane, WA 99216. (509) 928-8416.*
J.M. Lupperger Plans, *947 Joann St., Costa Mesa, CA 92627.*
Chuck Anderson, *P.O. Box 305, Tullahoma, TN 37388. (615) 455-5788.* ■

EASY-TO-MAKE WHEEL CHOCKS



by Joel Rindler

Safety should be one of our major concerns; these chocks help the cause.

Wheel chock doing what it does best—helping to protect a modeler's hands.

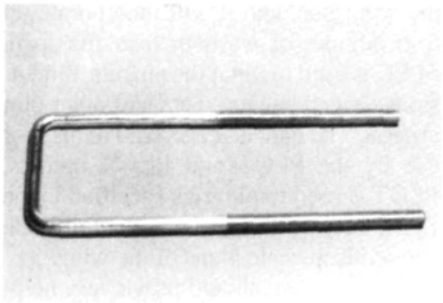
When your favorite mill roars to life, and you'd like to prevent it from chewing your fingernails clear back to your wrist, consider making a pair of these wheel chocks.

It's always safest to fly with a friend who can hold your plane while you start your engine. If you must fly by yourself, a pair of firmly anchored wheel chocks could really come in handy to help restrain your ship. For safety's sake, you should always start your engine when it's set on idle.

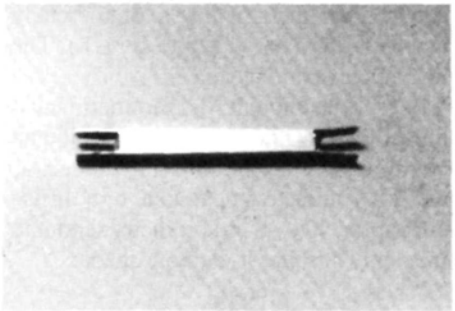
Some of my fellow club members have wheel chocks that were built using welding tools, which I didn't have. I therefore chose to make my chocks from a length of 1/4-inch square K&S brass tube and two 7x2-inch U-bolts bought at a local hardware store. The only tools I needed were a soldering iron (with some silver solder) and a Dremel tool with a cut-off wheel, or whatever you have in your shop that will cut and trim the 1/4-inch square brass tube.

The process is simple and quick (15 to 20 minutes, tops); just follow the steps outlined in the pictures.

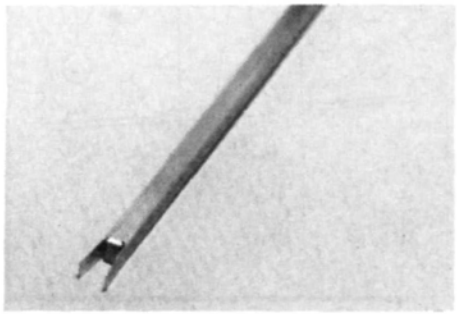
To knock the chocks into the ground, I use a rubber mallet, which I keep in the trunk of my car for replacing hub caps. So far, I haven't had any need to grind points on the ends of the bolts but, depending on local conditions, you might have to.



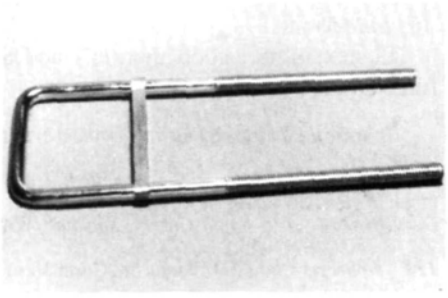
1. U-bolt minus nuts.



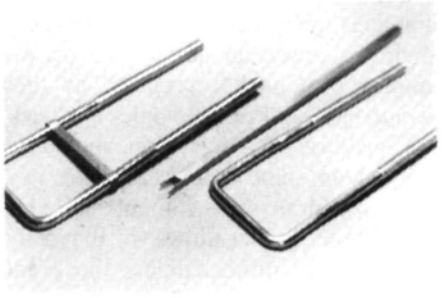
2. 1/4-inch square brass tube trimmed at one end to create two 3/8-inch tabs.



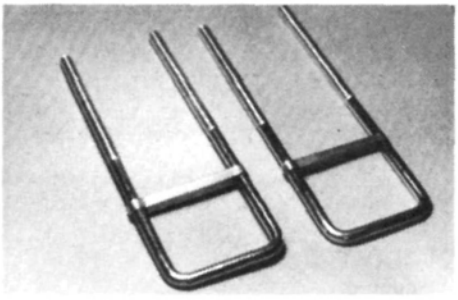
3. Complete cross-piece (cut to width required by U-bolt size) with tabs at each end.



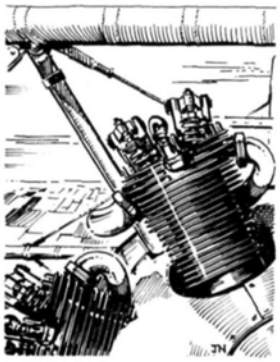
4. Tabs wrapped around U-bolt and silver-soldered into place.



5. One chock is completed and the second is on its way.



6. A completed pair of chocks.



Four-Cycle Forum

by CHRIS ABATE

PLAYING IT COOL

MY LAST COLUMN dealt with setting the valves on our 4-stroke engines. We learned that setting the valves improperly can rob the engine of power and rpm. An engine that overheats is another enemy that produces the same effects. Since our 2-stroke and 4-stroke engines are air-cooled (4-strokers run hotter than 2-strokers), you must make sure that an adequate flow of cooling air passes over your engine.

If the engine isn't enclosed in a cowl of some type, the air flow will be more than sufficient. Problems start to develop when we enclose the engine, e.g., in a scale-type aircraft where we try our best to conceal as much of the engine as possible. This is where the problems begin, but there are ways to avoid them.

Let's take, for example, an engine that's completely exposed on all sides, including the top and the bottom. Here, the air flow will obviously be adequate. Even if the engine is partially enclosed, as most sport-aircraft engines are, overheating probably won't be a problem. This is because most of the engine (especially the cooling fins) is exposed to a good air flow.

But let's look at a fully enclosed engine.

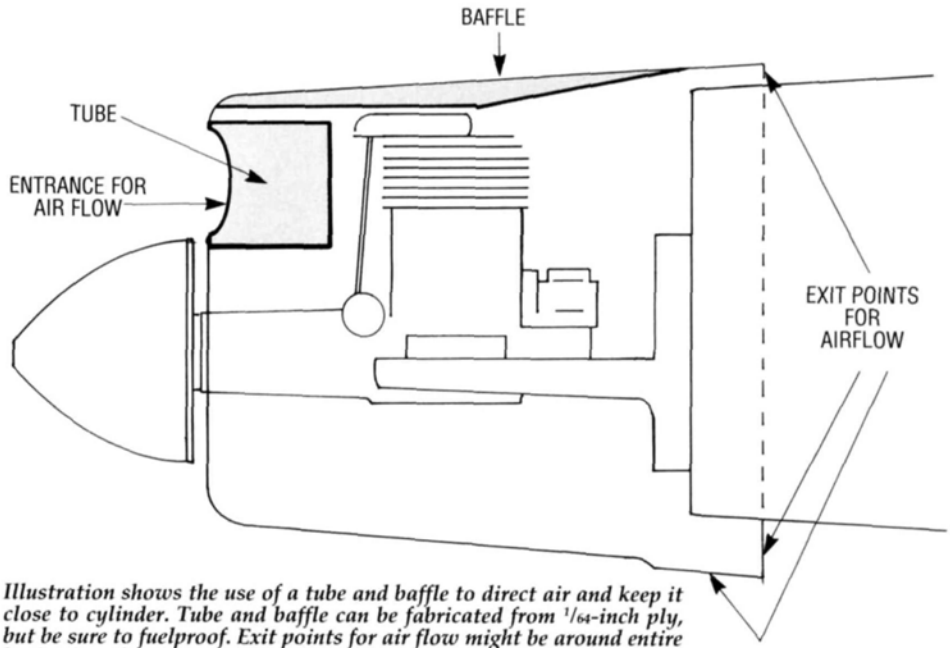


Illustration shows the use of a tube and baffle to direct air and keep it close to cylinder. Tube and baffle can be fabricated from 1/64-inch ply, but be sure to fuelproof. Exit points for air flow might be around entire back edge of cowl and at bottom. The basic idea is to provide a controlled flow of cooling air.

There's more than one way in which an engine can be completely enclosed. Take an engine that has a cylindrical cowl like that found on a T-6 Texan, a Corsair, and most of the WW I type of aircraft: Even though the front of the cowl is completely open, air flow could be restricted, because the air has no problem getting *into* the cowl, but getting *out* is the problem. We've made a nice opening for the flow of air to enter; now let's make one for it to exit.

The P-51, PT-19 and Cessna 150—to mention just a few—are other examples of planes with completely enclosed engines. With this type of cowl, the front end is no longer open, and air scoops, or slots, are used to supply the necessary cooling air. Remember, the air stills still need an exit.

Now that we have the air entering and exiting, let's use it to full advantage and maintain a supply of "unheated" air to the engine. OK, OK; it's 101 degrees in the shade and I'm talking about "unheated" air. Remember, while the engine is running, it's generating heat—lots of heat. The more area, cavities, or obstructions

(Continued on page 97)

Conley Caper

FLASH!! Just as we go to press, I've been informed by a representative of Conley Precision Engines that the company has been bought by an as-yet-unnamed buyer. The word is that only the Conley 1.20 DOHC engine and its derivatives are affected. The Conley V-8 engine will apparently remain with Conley. I gave you some preliminary information on the 1.20 in the February issue, and I was about to embark on a full-blown test, including flight performance. I don't know whether production will be continued by the new owner, but I'll bring you additional information as it becomes available.Until next month: Stay *cool!*

PHOTOS BY CHRIS ABATE

FIELD & BENCH REVIEW

IF YOU'RE FAMILIAR with airplanes like the Skyhawk, the Eagle and the Falcon, you know these are fire-breathing, heavy-metal, turn-and-burn aircraft. But let's slow things down a bit and look at a little biplane called the Parakeet, manufactured by Tidewater Hobby Enterprises*.

TIDEWATER HOBBIES

Parakeet

by CHRIS ABATE

A compact-sized biplane for small-field fun

The Parakeet was designed by Dave Robelen, who is an aeronautical engineer. It's basically an all-balsa aircraft that utilizes a handful of lite-ply (poplar) parts. The fuselage has 1/8-inch-sheet pre-cut balsa sides and a 3/16-inch pre-cut balsa doubler from the rear of the cockpit forward to the nose. There are three main fuselage formers that are pre-cut lite-ply. Former No. 2 was a little too high and needed to be trimmed approximately 1/8 inch to allow the landing-gear doubler to fit under it. The formers aft of the cockpit are partial formers that give shape to the aft turtle deck. Below each of these formers are 3/16-inch-square balsa that are glued flush with the fuselage bottom. For its final shape, 3/16-inch-square balsa stringers are glued to the aft turtle deck formers. The forward upper portion of the fuselage is a pre-shaped balsa block with a 3/8-inch slot cut into it. This receives the pre-cut 1/8-inch balsa sheet upper-wing pylon. To create a cavity for the top of the fuel tank to fit into, the top block will need to be hollowed out. The bottom of the fuselage, forward of the wing cutout, is sheeted with 1/16-inch ply and it runs all the way to, and flush with, the front of the fire wall. Aft of the lower wing saddle is the typical 1/16-inch balsa sheeting, which is glued in cross-grain. The engine mounts are maple rails that run through pre-cut slots in the fire wall and are glued to the fuselage sides and the fire wall.

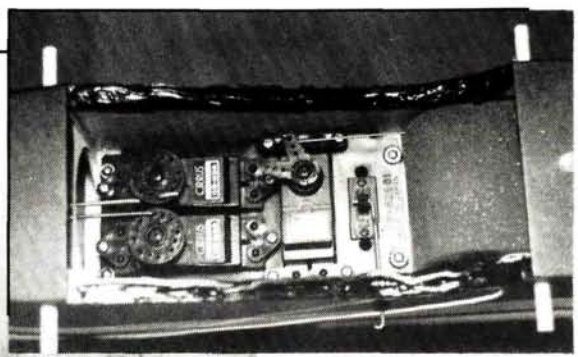
You'll probably think that something is wrong, but the engine needs to be set at 5-degrees right thrust. This seems like a heck of a lot, but my flight testing verifies that it's just the right amount and works out just fine. Tail surfaces, including the elevators and rudder, are all solid 3/16-inch balsa sheet and have been machine-cut to shape. The elevator halves are joined with a 3/16-inch wood dowel.

The wings are constructed from 3/32-inch balsa ribs, which are also machine-cut. Each wing panel has a 1/4-inch balsa rib at the root. These thicker ribs enable the builder to bevel-sand each panel and achieve the proper dihedral. Both upper and lower wings utilize a top and bottom main spar and a pre-shaped trailing edge that's pre-notched for the ribs. Although the notches didn't match the plans, I used the notches as cut with no problem. The leading edges of the wings are 1/4-inch diameter wood dowels that slip into half circles at the front of each rib. Neither wing has

SPECIFICATIONS

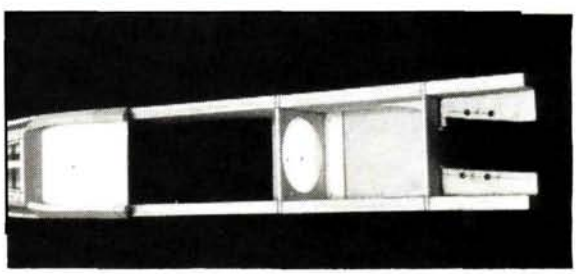
Type: *Sport biplane*
Wingspan: *42 inches*
Length: *34 inches*
Weight: *2 1/2 pounds (review model: 3 pounds, 1 ounce)*
Channels: *3 (rudder, elevator, throttle)*
Engine: *.15 - .25*
Suggested Retail Price: *$69.95*
Features: *Conventional lite-ply and balsa construction. Rolled, printed plans. Pre-shaped upper wing center section.*
Comments: *Easy to build. Pylon-mounted upper wing struts complicated cabane strut arrangement. Unique, interplane strut-attachment method is simple and uses readily available hardware.*

leading-edge or center-section sheeting, but the top wing uses a solid balsa block that's pre-cut to an airfoil shape and makes up the wing center section. To accept the 1/8-inch lite-ply dihedral braces, slots are cut into this block spanwise. These dihedral braces are glued to the aft face of the wing main spars, as well as to the center section along with the root ribs. The dihedral brace notches that are pre-cut in the solid-block center section were off approximately 1/4 inch, so I had to cut new slots and fill the old ones with scrap balsa. To prevent it from splitting grain-wise, this center section (as noted in the instructions) is wrapped with fiberglass cloth and is attached with resin. The outer wing struts are pre-shaped 1/8-inch lite-ply that are attached to the upper and lower wing using a Du-Bro* ball and socket. The socket is threaded on a 2-56 threaded rod and a hole is drilled into the wing spar into which the threaded rod is glued with epoxy. The socket portion can then be adjusted up or down. To attach the ball assembly, drill a hole through the strut. The threaded shaft of the ball goes



Radio compartment easily accommodates three tray-mounted servos. Generous use of foam protects receiver and battery pack.

In spite of its small size, the Parakeet doesn't seem to be seriously affected by light winds. Design lends itself well to "customizing" with wheel pants, minor outline revisions and personalized pilot figures.

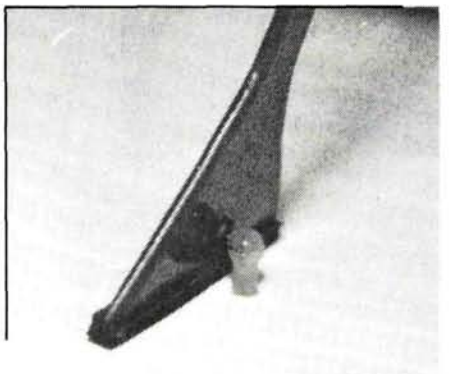


Forward end of fuselage shows simple structure. Note large (5-degree) right thrust incorporated into engine rails.

through this hole and is secured with a nut. This is a neat, quick setup for attaching wing struts and its application can be used on other similar installations.

A couple of nights' work and your Parakeet will be completely framed up. To aid in the assembly, three pages of step-by-step instructions and the single plan sheet are provided. Although no photos are used, they'd probably be welcomed by some newer builders who have limited experience.

After sanding everything down, it's time to cover. I used Coverite's* Black Baron Metal Flake Red. I've used it before and was very pleased with the look it gives in direct sunlight. Since no de-



Du-Bro Ball-Links are used to provide simple attachment method for interplane struts.

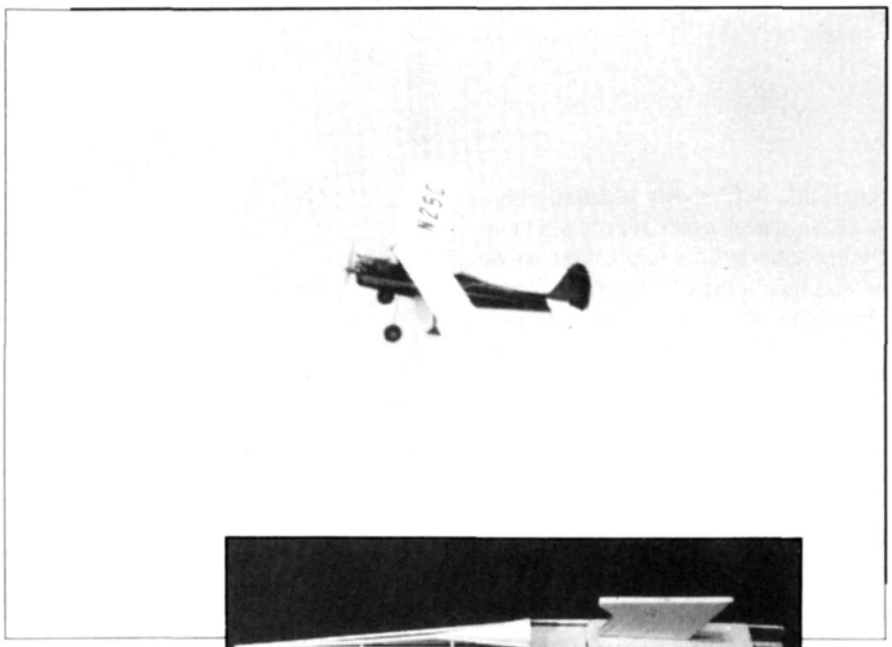
cals or markings are provided, I made the numbers and trim from Coverite's Presto Trim Sheets.

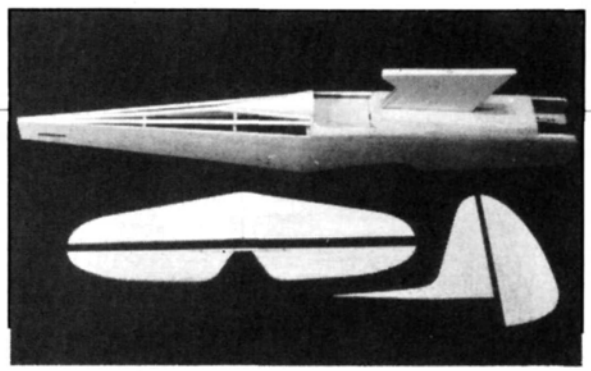
The radio used in the Parakeet was one of my old reliable 5-channel Cirrus units. It has standard-sized servos and uses an equally standard-sized 500 mAh battery pack. This is one of the reasons I like the Parakeet: "Mini" airborne equipment isn't required. Although specific locations for the components aren't shown on the plan, the positions shown in my installation photographs worked out well, and required no additional ballast for CG control. There's plenty of room for shifting the actual components.

The engine I selected for the Parakeet was the K&B* Sportster .20 and, supplied by a 4-ounce tank, it gave flight times well above 9 minutes, right out of the box. The engine performed very well,

(Continued on page 48)

PARAKEET





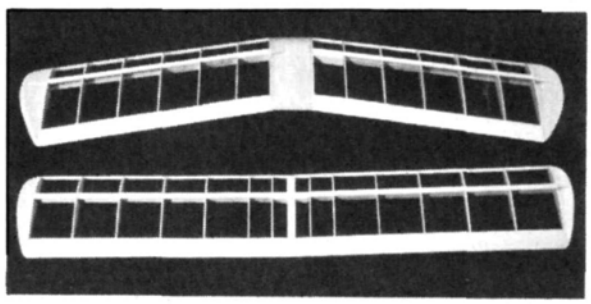
Fuselage and tail group ready for covering. Single "pylon" for upper wing mounting eliminates need for usual "birdcage" cabane struts.

despite the 29-degree temperature.

PERFORMANCE: OK; the moment of truth. With all controls set according to the manufacturer's instruction, the CG at the indicated location and with a full tank of fuel, it was time to fly. Now, keep in mind that this is a 3-channel ship—throttle, rudder and elevator—don't expect the Parakeet to do the full FAI pattern program. It won't. Because it's a tail-dragger, you'll want to advance the throttle slowly, while holding a little up-elevator. As the ground speed increases, relax elevator to the neutral position to raise the tail, and then re-apply a little up-elevator and you're airborne. During the takeoff roll, rudder was applied as needed. Once airborne, as throughout all speeds, the rudder is very effective. Turns are crisp and no tendency to fall off was noted. Loops can be executed with little problem; just pull back on the stick. If you want to roll, make sure you have plenty of air space between the wheels and the ground before you crank the stick over!

Set-up for landing was uneventful. Get on final and slowly start to reduce power till you're just over the threshold, chop power and touch down. Watch crosswind taxiing, because at 3 pounds, 1 ounce, it won't take much to tip it. Other than that, I found it a very easy plane to fly. I think you will too.

**Here are the addresses of the manufacturers mentioned in this article:*
Tidewater Hobby Enterprises, *3925 S.E. 45th Ct. #C, Ocala, FL 32671.*
Du-Bro Products, Inc., *480 Bonner Rd., Wauconda, IL 60084.*
Coverite, *420 Babylon Road, Horsham, PA 19044.*
K&B Manufacturing, *12152 Woodruff Ave., Downey, CA 90241.* ■



Upper and lower wings shown here in frame. As Parakeet is a 3-channel airplane, no ailerons are used. Swept upper wing adds visual appeal.

Golden Age of

by HAL "PAPPY" deBOLT

AS I'VE SAID before, you never know what you might find stored in that dark corner! What was found mixed in with a pile of old magazines seems so pertinent to OT R/C that I'll digress from my usual format and describe in condensed form a most unusual bit of R/C history. Even so, the report will be lengthy. I'm sure you'll find it not only interesting, but also eye-opening. Because this is outside the realm of general OT R/C happenings, it's a good example of how R/C was being investigated in other fields.

As a teenager in the early '60s, Bill Kuhlman's first R/C was a Nomad glider, using a C-G transmitter and a Citizen-Ship receiver. He flew the Nomad by tossing it out the front door of his home, which was on a slope in Malibu Beach, CA. He said slope soarers still operated at that same spot many years later. Did Bill originate the idea?

After high school in '63, Bill enrolled in Purdue University and joined the Purdue Aeromodellers. Bill Wischer (then a Nats winner in rudder-only) taught him how to fly with power, using a .049 Wildfire biplane. Wischer was an accomplished pilot, who demonstrated rudder-only rolls through the athletic-field goal posts—on takeoff yet!

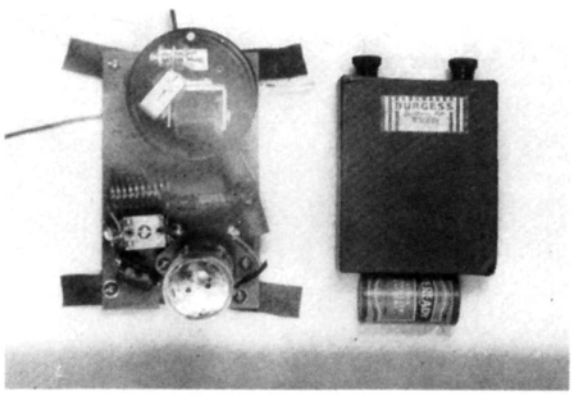
Frank Dies was president of the Aeromodellers, and he won the first Nats sailplane event. While at Purdue, Frank experimented with laminar flow airfoils for pattern. Frank had problems trying to produce laminar flow, but the good results that others had later on showed him that he had been on the right track. The report that I'll be using was dug out of the Purdue Archives in the '60s by Frank, and he gave it to Bill Kuhlman, who saved it all these years.

Ben Lanterman was also flying R/C at Purdue. His brother was the electronic engineer who took over at World Engines when Jack Port passed away. At the Toledo show, Ed Izzo demonstrated the first foam-core wing cutting! In the early '60s, the Purdue Aeromodellers were

The Purdue University 1/4-scale model of their projected XP-1 aircraft of the 1930s. Would fit today's scene neatly? Details in text.

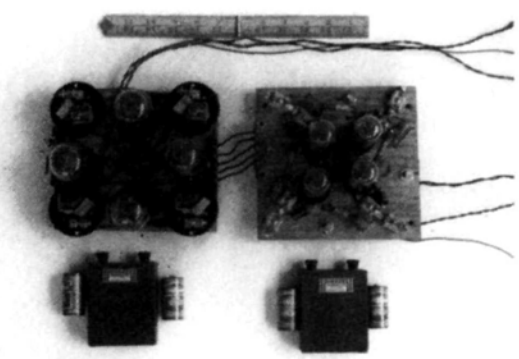
WITH THIS ISSUE, we begin the little-known, amazing history of early R/C development at Purdue University. What was done in the '30s was truly visionary and pointed the way to what's now common in the military and in industry. We think that giant scale is new? We are allowed this look into the past through reader input from Bill and Bunny Kuhlman of Ollala, WA. Bill was a student at Purdue during the early '60s and, as this account shows, he was lucky enough to obtain some enlightening reports. When the couple's two sons showed an interest in their former hobby, Bill and Bunny became active again in R/C. Today, they enjoy sport-style activities, with a major interest in flying wings, of all things! Bill is enthralled by the possibilities available today.

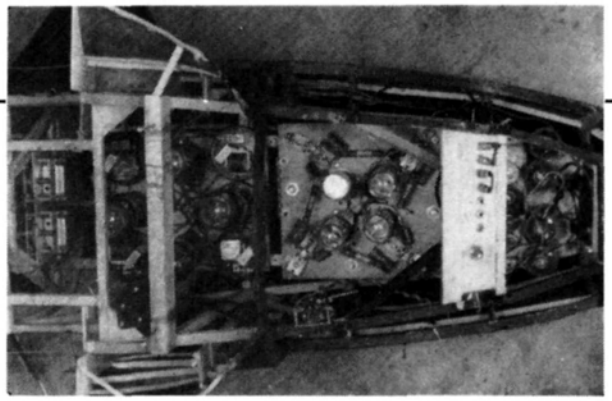
We hope this story shows how important you, the reader, are to our OT R/C place.



Left: nitial Purdue receiver and batteries. One RK-62 tube, weight 20 ounces.

Right: Final Purdue 4-frequency-channel receiver and battery complement.





An idea of the R/C complexity involved with Purdue's most advanced guidance system. Compare with today!

obviously at the forefront of R/C. Remember, it was University student research that provided the data for the Bramco reed bank concept and, later, for commercial reed switches. It seems probable that the Purdue effort was only because of student vision. To appreciate what will be told, I'll set the stage for the R/C hobby in the years before WW II, say '36 through '39.

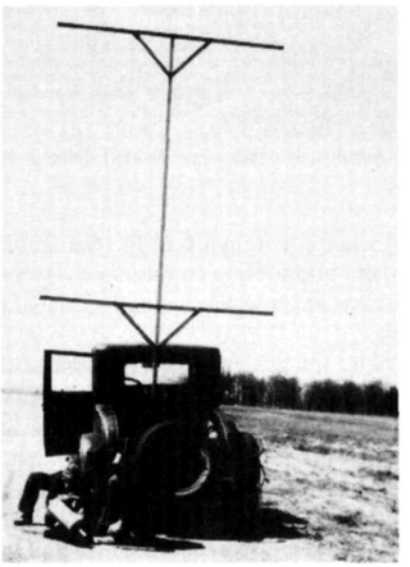
Held in '37, the first Nats R/C event had six or seven entries. The uncontested winner was Chet Lanzo, who made the only flight that lasted 2 1/2 minutes and featured a couple of more or less recognizable turns. In '38 and '39, the Good brothers won with the help of radio guidance. Back then, the R/C hobby could be compared to a baby's first crawl and then to stumbling steps. What seems remarkable for that time period is how advanced the Purdue effort was!

Whenever an organization is conducting a project, there's a lot paperwork; everything and anything must be described with reports. One report, dated May 28, 1939, was called "Progress in the Development of a Radio System Suitable for the Control of Small Unmanned Aircraft." It was written by K.D. Wood and L.G. deBey, who appear to have been the leaders in the work. Apparently, this is a final report covering several years of effort. Fortunately, many photos were included, so we can see what was done. It even looks impressive! I've condensed the extensive writing and will discuss the most interesting bits from today's point of view.

Today's industrial world includes RPVs, radio-controlled "proof-of-concept" drones and even remote-controlled full-size jet fighters! In the space world, computers precisely guide vehicles past the furthest planets. We take all of this for granted. Electronic control and radio guidance are today's accepted facts.

To appreciate the objectives of the Purdue projects, consider that, at the time, the outstanding news in electronics was the RK-61 tube that allowed miniaturization that wasn't very reliable! In that atmosphere, Purdue wanted to investigate the use of unmanned 1/4-scale versions of proposed new aircraft to determine the value of their aerodynamics. This was to be done with R/C, when the best that had been seen was only guided free flights!

The value of such an ability would have been enormous, because, in those days, test pilots were the main tool of research, NACA (NASA's predecessor) hardly existed, wind tunnels and other such test facilities were rudimentary, and there were no computers or even calculators to plug questions into. Model airplanes had proven useful tools for studying aerodynamics, and controlled miniatures would add so much more!



Purdue mobile broadcast station in the back of a Model A! Note gas-engine-powered generator and two of possible four antennas used.

What's amazing is the depth of Purdue's initial research, which was undertaken before anything else began. Normally, one method is explored until it becomes a yes or no. Not so with Purdue.

At this time, flying scale models of proven aircraft was, at best, marginally successful. R/C scale was hardly dreamed of—never mind experimental, unproven designs! With the only successful (?) R/Cs being special designs for that purpose only, Purdue envisioned the use of strictly scale miniatures. At this early point in their projections, you have to appreciate the vision these people had!

The initial research began with an investigation of what had been done with model-aircraft structures and power. Did such data indicate that 1/4-size aircraft could be structurally adequate? Would the miniatures be capable of carrying the anticipated heavy R/C weight? Were there available engines to provide the required power? Remember, this was still the heyday of the Brown Jr. There were no Quadras, Sachs or even Super Tigres! What controls would be required, and could a radio system be developed to operate them? That the project went ahead confirms positive thoughts in these regards. The projection was that success would be possible with flying weights up to 20 pounds. How familiar that weight ceiling sounds with today's 1/4-scale!

Actually, little research was done on the basic radio portion. Instead, they relied on the results of Clinton DeSoto and Russ Hull at the American Radio Relay League. These people had demonstrated possible miniaturized circuits, which seemed applicable. However, when it came to possible control systems, the

(Continued on page 98)

About Those E

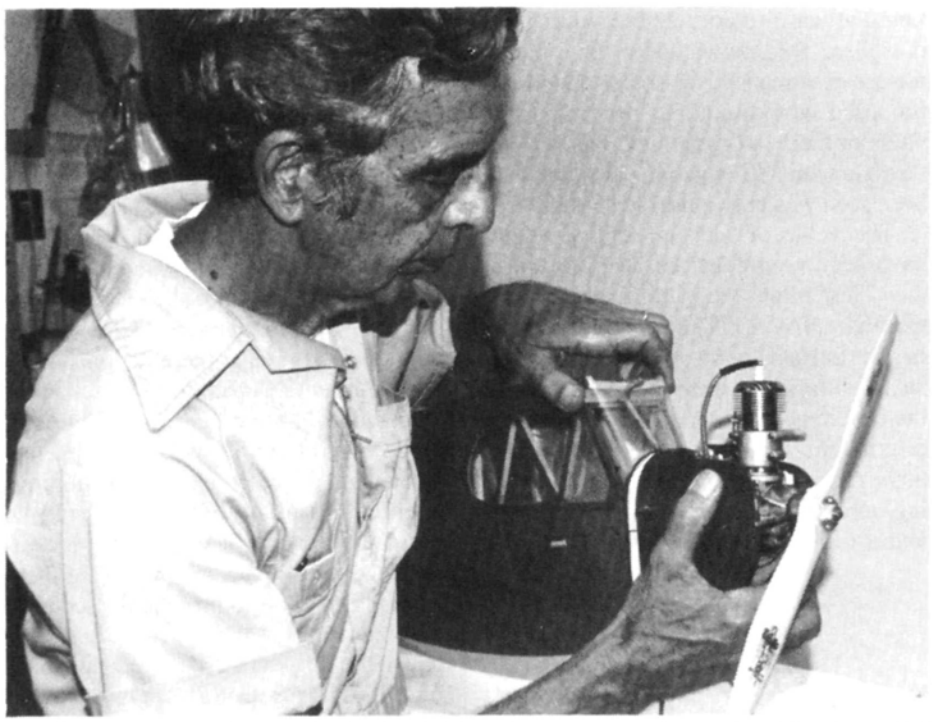
by JOE WAGNER

THIS MONTH, I'VE got both good and bad news for readers who are interested in modern reproductions of old-time model motors. First, the bad news: Some of these replicas are no longer available and probably never will be again. Makers of duplicates of famous old engines, such as the Super Cyclone, Morton M-5, the various sizes of Orwicks and the Bantam .19 have closed up shop. The many problems of manufacturing those motors proved to be too much for them.

Some of this news comes as a big relief to me personally, because the M-5 and the Bantam replications were being promoted by someone with the same name as mine who lived in Connecticut, not far from *MAN's* offices. His failure to make delivery of the engines and parts that had been ordered and paid for resulted in several angry letters to both me and this magazine—although we weren't involved in any way with the Bantam/M-5 replica project.

Now that's all over with. The Model Aviation Historical Society is out of business, and its proprietor, Joseph W. Wagner (I'm Joseph E.—a Pennsylvanian rather than a "Nutmegger"), has apparently moved to the Baltimore area, leaving what little remains of the Bantam/M-5 parts and tooling to molder away in a parking lot near the former MAHS factory.

Now for the good news! Most of the best-made replicas of old-time motors are still being produced—or soon will be. To begin with, Herb Wahl* has been manufacturing reproductions of spark-ignition motors for 23 years now, and he currently has available: Brown .60s, Ohlsson Gold Seals (.57), Hurleman Aristocrats (.48), and his own special rendition of the Bunch Tiger Aero .45.



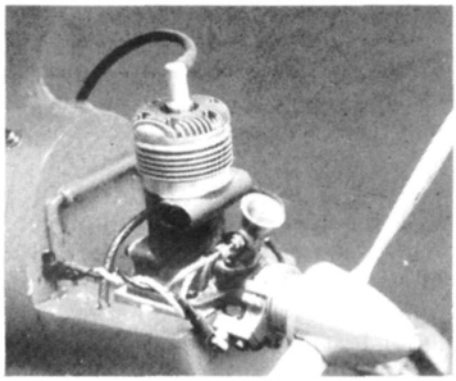
Herb Wahl with one of the meticulously duplicated engines of yesteryear he still sells: a 1938 Ohlsson Gold Seal .57.

All these are custom-made in one of the best-equipped small machine shops I've ever seen. Herb Wahl even makes his own injection-molded fuel tanks for these replicas! He has plans for duplicating a few other old-time model engines, but I'm not supposed to talk about them yet.

On the West Coast, a brand-new manufacturer of model motors has arisen: RJL Industries*, located in Los Angeles' San Gabriel Valley. Headed by Randy Linsalato, an R/C flier with 20 years of modeling experience, this new company has a unique approach. Its product range is a veritable spectrum of model engine makes and vintages, from 40-year-old spark-ignition Forsters to the new Schneurle-ported double-ball-bearing RJLK.61 R/C glow engine.

For the last few years, Randy has been busy tracking down and purchasing the manufacturing rights to several well-known model engines of the past. He has bought out Forster engines; acquired the Cox .15 Conquest design from K&B; and even dug up the remaining residue of a couple of old motors I thought had long ago vanished without a trace: the 1946 Viking Twin .65 and the 1957 Holland Hornet .049/.051.

Besides the types I've already mentioned, RJL owns the rights and tooling to make the McCoy Series 21 motors, the Kraft .61 R/C engine, the Taipan .40



A spark-ignition Edco Sky Devil .65 in an R/C version of Carl Goldberg's famous Comet Sailplane. Note the shielded plug. It's not really necessary, but it does no harm.

gines

ABC, the entire HGK line and the Remco .29.

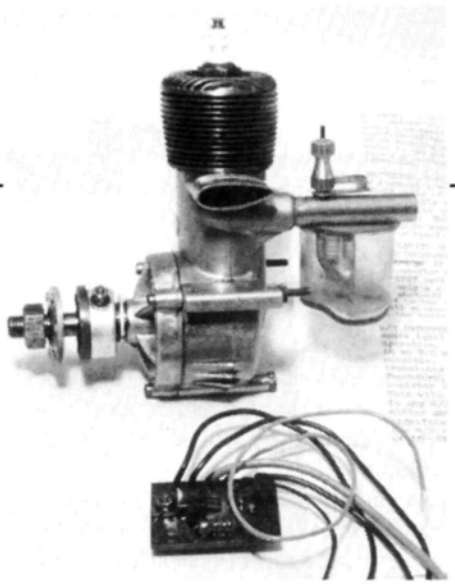
Not all of these motors are available now. Some might never be: the Viking Twin was a hopeless dud, whose two cylinders never seemed to be willing to work in harmony; and the original version McCoy Series 21 engines made few friends, except possibly among builders of extremely tail-heavy airplanes. Given the apparent ability of RJL, new, improved versions of both these engines aren't beyond the realm of possibility.

Engines now in stock at RJL are: Forster .29s and .35s (both spark-ignition and glow versions); RJL/Cox Conquest .15s (both R/C and control-line versions); and the RJL K.61 R/C.

Randy's machine shop is well-equipped, and is large enough to meet demands. What he makes will be determined largely by what modelers want. There would be little point in RJL's setting up to make, say, a couple of hundred Holland Hornets if they only got requests for 10 or 12 of these motors.

Besides, Randy Linsalato has his own engine designs to promote. I'll describe these in detail in a later column; for now, I'll just mention that they include opposed-type multi-cylinder motors for 1/4-scale and similar *big* R/C models. When I visited RJL recently (yes, I drove all the way to California and back, just to dig up information for you faithful readers of this column!), Randy showed me production prototypes of twin-, 4-, and 6-cylinder engines. They're mighty impressive. The 6 looks big enough to me to power an ultralight!

In addition to model motors, Randy also sells engine accessories: inexpensive glow plugs, tuned pipes, Modelectric spark coils, and 1/4-inch-32 spark plugs. RJL puts out a sort of brochure/catalog/newsletter (its masthead says, "published whenever we want"!) describing all the goodies they have available. Write to Randy for a free copy—and tell him



An Ohlsson .60 sparker in the background provides a good idea of the smallness of Floyd Carter's transistorized ignition module. (A coil, switch and batteries are also needed to run the motor.)

"Dakota Joe" sent you.

While I was out West, I contacted Floyd Carter, the cheerful proprietor of Aero-Ply Research Company*. Floyd knows as much about spark ignition for model engines as anyone I've ever met, and he's happy to pass his knowledge along to other spark-ignition fans.

If you're wondering why anyone would want to go to the trouble and increased cost, complexity and weight of a spark-ignition system nowadays, when glow and "diesel" motors are state-of-the-art, here's

Packaged in an original Forster Brothers box, this is one of the replica glow-version Forster .35s now being made by RJL Industries.

how I see it: With spark ignition, you have total control of the exact instant the fuel-air mixture ignites in your engine's cylinder. Regardless of temperature and humidity changes, you can use the same fuel (FAI-type 3:1 methanol/castor oil mix is best) and make your engine run at any percentage of its power output. If, for instance, you have an Edco Sky Devil in an R/C Comet Sailplane, and you want to fly it in a sedate, relaxed fashion, instead of a rocket-like climb-out, you just leave the "timer points" in their low-speed, "retarded" position. To fly the same airplane in Old-Timer R/C Assist competition, after getting the Edco running (at "full retard", for safety and easy starting) you advance the points to their maximum rpm setting, and you're ready to try for a trophy.

Floyd Carter's contribution to this technique is his TIM-3 transistorized spark-ignition module. Using it eliminates practically all the operating problems of spark-type model motors. It's tiny, weighs less than 1 ounce (including all its wiring) and has nothing to go wrong. Even reverse polarity of the batteries (three 500mAh Ni-Cds connected in series are recommended) won't harm it. Not many transistorized devices can make that claim! The TIM-3 module, fully assembled and with all components sealed in potting compound, sells for $16.50, postpaid.

Because of the possibility of RF interference generated by the engine's ignition circuitry, some modelers might have doubts about using a spark-type motor in a radio-controlled airplane. Floyd pointed out that, although his TIM-3 module isn't intended as an interference suppressor, it does eliminate any problems that arise from sparking at the engine's timer points. Without the TIM-3, these contact points make and break a 3-amp circuit. If the timer housing is open (as on a Super Cyclone, Brown, Orwick, or Bunch engine), the sparking across the timer points can glitch some brands of R/C systems. But the transistorized module cuts the current flowing through the timer points down to about 25 milliamps. That's low enough to eliminate just about all troub-

(Continued on page 111)

Helicopter Challenge

by CRAIG HATH

THE ROTARY-WINGED craft is probably the most complex flying machine that we know. If you stop to consider all the moving parts that collectively make up our machines, it's a little mind-boggling. Some of my flying friends who don't get involved with helicopters read my column, and they often comment that they only understand a small percentage of what I've written. Now, these are aviation-oriented people, and they're still somewhat in the dark about helicopters. Perhaps there should be more information about helicopters made available. Pick up nearly any model magazine and you'll see plenty of airplane articles, i.e., scale, aerobatics, sport and reviews. Maybe there will be one helicopter column.

How would you like to have <u>your</u> shop stocked this well? Friend Bob Pickens runs a small supply business from his home. Helps to keep local fliers going, as well as himself.

I've already mentioned that I compete in pattern, and I'll race Quickee 500 at the club races (last year, I finished 2nd in my district in Expert Class Pattern, and 2nd in Q-500 club standings), but I fly helicopters. Most of the people who fly helicopters with me also fly fixed wing. Still, with all that we have in common, fixed-wing fliers don't understand helicopters and the nuts who fly them, and they often don't tolerate helicopters. Why? Maybe the helicopter fliers need to do some explaining to their fixed-wing partners. How about taking a few seconds to let them know that you respect the type of flying that airplanes dictate, and to tell them that you don't intend to get in their way.

Another point is that you're able to fly out of their way completely, and if they want to announce their intentions, you'll be glad to oblige. This misunderstanding about helicopter pilots appears widespread enough that some fields post signs prohibiting model helicopters. The result is that some of the people who want to participate in both activities won't make the changeover, since they'd have to fly at more than one, convenient flying site. If you agree that this is nonsense, then try to do something about it. If you ask any of the fliers at my local field, they'll tell you that I stay out of their way, and I do my helicopter stuff off to one side until I put the machine in forward where it has the same rights as a fixed-wing ship. Let's try to get along. The sport is growing too fast to be ignored, so why not blend in? Enough said.

Scale ships attract a lot of attention. If you have a nice scale model, send us a black-and-white photo with a note covering the details, and we'll show it off to the rest of the world.

Start of a loop being performed by Tom Hart's GMP Cobra. Just ease into the maneuver; never jerk the machine through the sky.

Dan at the top of a normal loop, letting it float over the top, making the loop very rounded.

I'm smack in the middle of a series about flight training. Last month, we worked on the stall turn. If you have a good grip on the stall turn, you'll be ready to start looping the helicopter. A loop is performed when the craft flies up and over in a circle and finishes at the point where it began. The loop can be a lot of fun with a model helicopter, and it can be disastrous, too. I've seen all sorts of things happen to looping helicopters, although I must admit that most of the trouble was in the early days when none

(Continued on page 56)

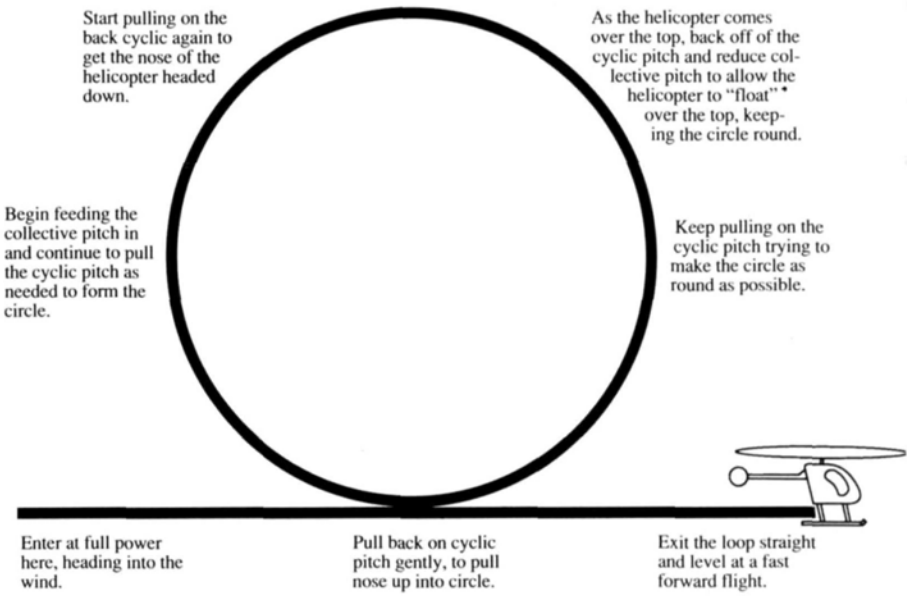
HELI CHALLENGE

(Continued from page 54)

of us was really sure about what we were doing in the first place.

Let me detail the control inputs that will make up the normal loop. With the helicopter in level forward flight at moderate speed, the cyclic pitch is eased back, pulling the nose of the helicopter upwards.

LOOPING THE MODEL HELICOPTER

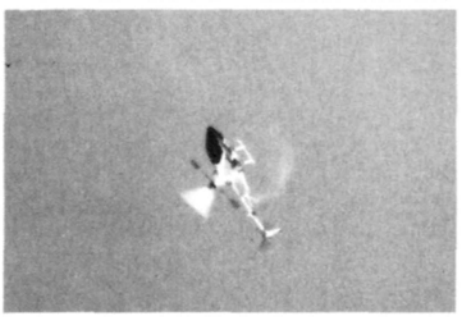


The back cyclic is held as the helicopter comes over to the inverted position. At this point, the collective pitch is backed off to about zero, or even down to negative pitch a little, and the cyclic pressure is eased off also. The helicopter will then "float" over the top, and the nose will begin to drop toward the ground. As the air speed increases, the cyclic will be pulled back once again, and the collective pitch will be fed in as the machine starts to head back to the level, upright, position. When the helicopter returns to level, the cyclic pressure is relaxed and the machine flies away straight and level.

Sounds pretty simple, right? Let's take a closer look at the elements of the loop and discuss some of the things you might be on the lookout for while performing this maneuver. To begin, you must have a sound platform for performing any aerobatic maneuver. Be sure that your machine is in top-notch condition and that you've trimmed it to the best of your abilities. Taking the time to cover your bases here will make your life much easier.

Pay particular attention to the engine, as you'll now be placing loads on it that you hadn't before. You'll want to be just a hair on the rich side with your mixture setting, so that maximum power is available. Be sure that your pitch settings at the top end allow you to operate the helicopter at full throttle. I always feel the most comfortable with the rotor speed increasing just slightly above hover speed at full throttle. This way, I'm assured that the engine isn't overloaded (a condition that will overheat the engine and often cause it to quit in flight). I've seen a few crashes that were the result of a flame-out at the top of a loop. Although accidents will occasionally happen, try to eliminate any potential problems.

Now that you're sure about the state of your equipment, you'll be ready to start your first loop. The loop is usually performed into the wind. With this in mind,



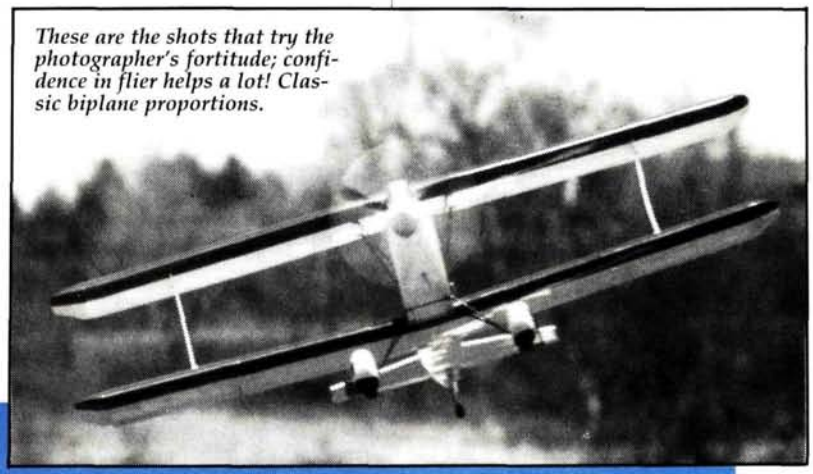
Doing a twirl at the top of this loop, Dan Melnik makes it look easy because he practiced a lot.

orient the flight path of your helicopter so that it's both coming toward you and heading straight into the wind. Until you become familiar with the size and amount of air space that your machine will require, have the helicopter at a reasonably high altitude when entering the first few loops. To point the nose down slightly and to get the helicopter moving at full speed,

(Continued on page 111)

WALT MOUCHA MODELS

CHARGER MARK II



These are the shots that try the photographer's fortitude; confidence in flier helps a lot! Classic biplane proportions.

NEW COMPANY, NEW KIT...AND A NICE-FLYING, HONEST AIRPLANE

PHOTOS BY RICH URAVITCH

SPECIFICATIONS

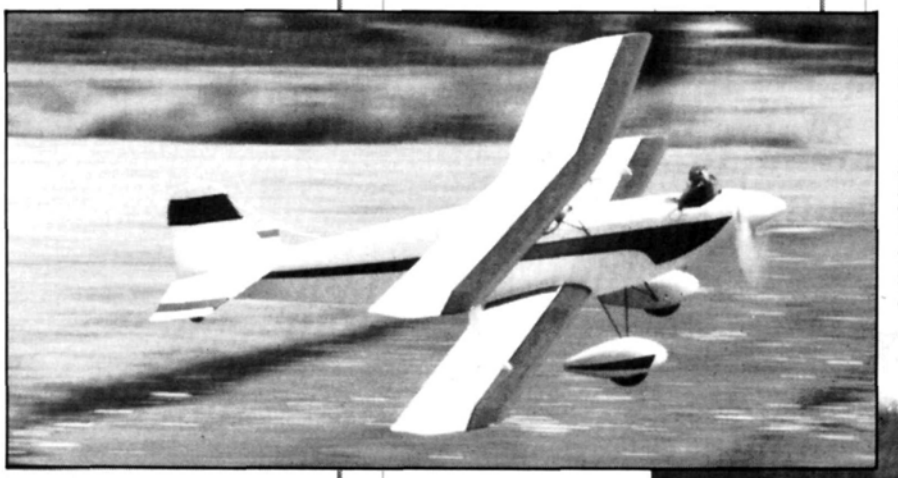
Type: *Sport biplane*
Span: *60 inches*
Weight: *9 1/4 pounds*
Wing Area: *1,080 square inches*
Radio: *4 channels required*
Suggested Retail Price: *$64.99*
Features: *Semi-symmetrical airfoil, two open cockpits, balsa and lite-ply built-up construction.*
Comments: *This is a particularly sporty-looking biplane, which offers the pilot a highly satisfying aerobatic model. The kit is for the builder with "intermediate" skills.*

by DICK PURDY

MR. WALT MOUCHA, a long-time employee of Balsa USA, has now established his own business in Menominee, MI, and has created a new line of airplane kits that he markets directly under the name of Walt Moucha Models*. I've just completed one of Walt's new kits: the Charger II. It was an interesting project that resulted in a sporty-looking model that flies really well.

Walt advertises this model as being suitable for those with "intermediate skills" in building, so beginners or "low-time" builders should be warned. I won't say the kit is difficult to assemble, but the instructions are scanty and they require some experience to interpret fully.

When completed, the Charger II is a sleek-looking biplane. With semi-symmetrical airfoils and a light wing loading, the model is capable of a full aerobatic program.



Left: From the very first takeoff, it was apparent that the Charger would be a very predictable, pleasant-flying bipe.

Below: A dapper, bundled up Dick Purdy braved the frigid Northeast winter to complete this project. The three-bladed prop, in conjunction with an already quiet 4-stroke, makes this a "neighbor friendly" bipe.

However, building it did stretch my patience a bit, so, on with the story!

The kit box contains 15 die-cut sheets of high-quality, well-cut balsa and lite-ply and an adequate supply of stick balsa and spruce. The hardware package is complete and also of good quality (it includes pre-formed cabane and landing-gear wires). You'll have to supply an engine, radio, covering, a tank, adhesives, wheels and wheel pants, which are optional and offered as an "add-on" item. You could add a pair of pilot figures to occupy the two open cockpits, and a 3-inch-diameter spinner is really a must for smooth, flowing, fuselage lines.

My particular kit was short of sheet material (one sheet each of 3/32- and 3/8-inch balsa), two lite-ply wing ribs, plus one tapered trailing-edge piece for one wing. I had stock in my shop to cope with these omissions, but they were obviously annoying. The instruction manual is a small 12-page booklet that includes several helpful photos. There are two, good-quality, full-size drawings, and I didn't find any discrepancies between the plans and the instructions, but there were some "sins of omission" in the text, e.g., there's no mention of the need to install blind-nuts in the fire wall for the engine mount before gluing it into place, or of the need to fuelproof the fuel-tank compartment. This is the type of guidance that a novice needs, but won't find, in this project.

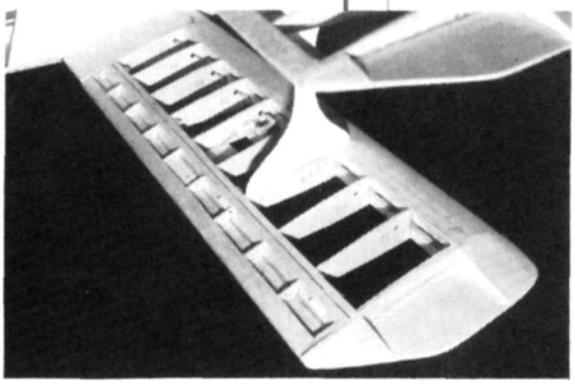
ASSEMBLY: Using lite-ply side panels with doublers at the front, the fuselage is built first. Balsa sticks form a built-up aft section and a rear turtle deck, and the forward top deck is formed with 1/64-inch plywood bent over formers and stringers. The cockpit openings can be cut in this super-thin material after it has been glued into place. That 1/64-inch plywood is fragile, and it must be installed with care! The fuselage drawings show an Enya* .90 4-cycle engine mounted at the nose, and that engine is shown with a 3-inch-diameter spinner. I bought one of these engines and a Tatone* engine mount, and I felt that I had that part of the project well in hand. Later on, I discovered my error!

Next comes construction of the wings. The upper wing has a swept-back planform with no dihedral; the lower wing has no sweep-back at all, but it does have moderate dihedral. There's no special trick to building these very conventional wings, but the instructions are rather deficient on how you should join the wing halves with their upper and lower balsa sheeting at the center section. Just think it through and follow a definite plan, and you'll produce some really nice-looking wings.

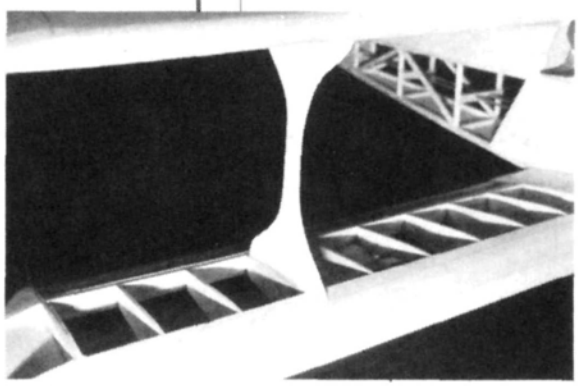
The tail feathers are all of solid balsa sheet, and there are no complications in shaping, sanding, hinging and covering these pre-cut parts. As fillets between the stab and the fin, two supplied balsa blocks are contoured to match the rear taper of the fuselage.

When the wings have been constructed (with the ailerons fitted), the bellcranks installed, and the servo cutout completed on the lower wing, it's time to fit the cabane struts. These have to be wrapped with copper wire and soldered at the joints. First, I found that the two pieces of pre-formed wire for the diagonal cabane braces were too long to fit as shown on the plan, but simply by reversing their direction, that problem was easily overcome. However, after completing the cabanes, I found that the pre-cut inter-plane struts were 1/2 inch too long. By cutting 1/4 inch off the top and bottom of each one and carefully following wing-rib contours, these were fitted into place.

My Enya .90 4-cycle engine, the



Uncovered wing structure shows conventional design with no surprises for the builder with limited experience. Built-up ailerons aren't usually seen.



The interplane struts are die-cut from lite-ply. The attachment method is simple, rugged and designed for quick disassembly at the field.

engine mount, a 14-ounce Sullivan* tank, tubing and padding were then installed. I fitted the servos, pushrods, receiver, Ni-Cd, switch, charge receptacle, antenna and landing gear in the bare-bones fuselage, then I removed them and did more sanding and final preparation for covering.

For covering, I used Black Baron* film, which is my favorite covering material. Everything was covered in white and trimmed with Fokker Red (a Black Baron deep red), and black striping tape was used at the seams between contrasting colors. As you'll see in the photographs, the finished scheme is highly visible and aesthetically pleasing.

When I'd completed the covering and re-installed the radio controls and the engine components, a matter of some frustration (and evidence of my own inadequacy) came to light: The Enya .90 4-cycle engine wasn't designed to accept a spinner! By making a call to the factory, I learned that Walt Moucha Models used the Enya on the drawings because they had a template of that engine and this made it easy to draft, so they could offer no suggestions on how to use the Enya with a spinner. Next, I called the folks at Altech, the company that markets the Enya in the U.S. This call also proved fruitless. I then tried the C.B. Associates in California, hoping for some solution to a spinner design that they could have developed. Still no luck!

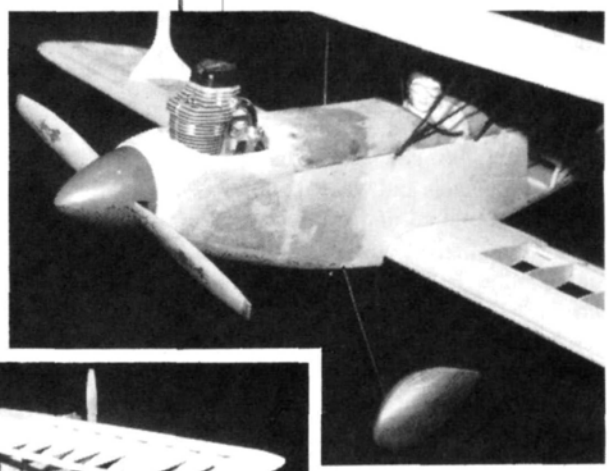
At last, help came from a much closer source. A fellow club member, Russ Pribanic, who's a good friend and a superior machinist, came to my rescue. The solution lay in drilling and threading a hole at the precise center of the prop nut. After that, the spinner backplate and the plastic cone were easily fitted on. Eureka!!

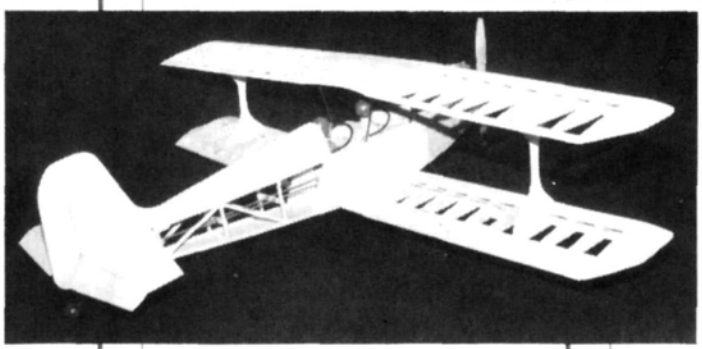
I obtained fiberglass wheel pants for the Charger from Fiberglass Master* and when I'd prepared and painted the surfaces, I mounted them securely with a set of special collars from Sig*. Using the wheel pants doesn't incur a significant weight penalty, and they greatly enhance the sporty appearance of the plane.

PERFORMANCE: Having completed and tested the radio and engine installations, it was time to fly this sweet-looking bird. On a clear, brisk, moderately windy winter day, Rich Uravitch and I kept our date to fly the Charger and to record the event in full color.

The initial flight was preceded by the appearance of my customary white knuckles and quivering

(Continued on page 120)





Above: The Enya .90 4-stroke is an ideal powerplant for the Charger, but a .60 2-stroke would work equally well.

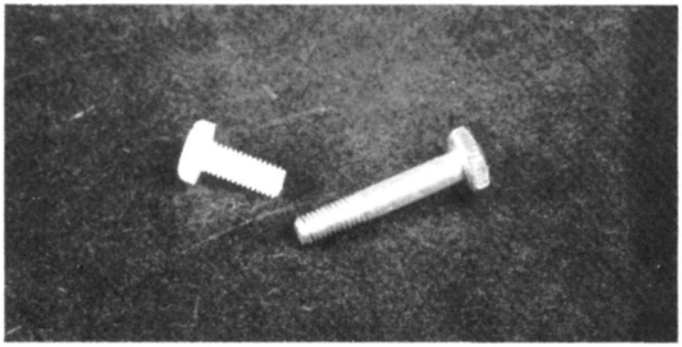
Left: This is what model-biplane building is all about: a beautiful, all-wood framework with just the right amount of open area to create the "rag-and-tube" appearance.

How To:

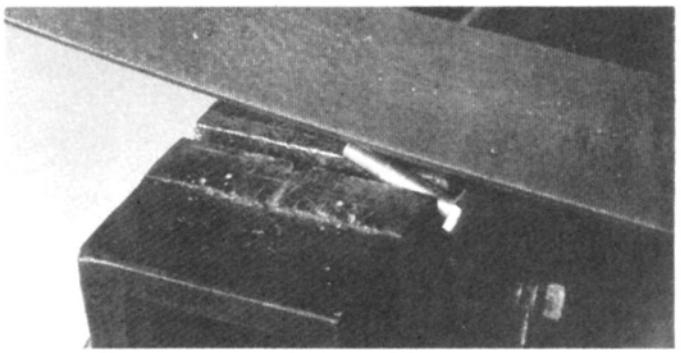
by RANDY RANDOLPH

MAKE A TAP FOR NYLON BOLTS

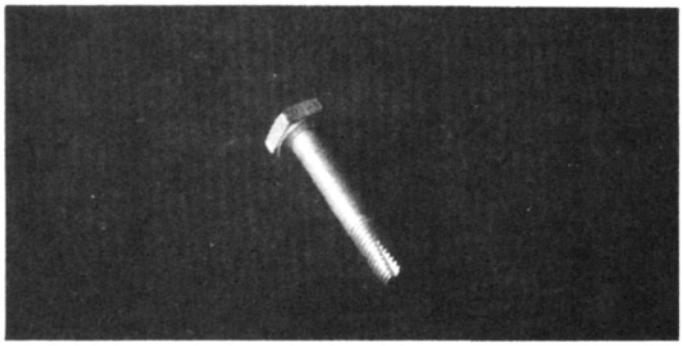
Nylon bolts are ideal wing-mounting replacements for rubber bands as they rarely require replacement and aren't affected by oil and fuel. The photos show how to make taps for threading plywood or hardwood blocks to receive these bolts.



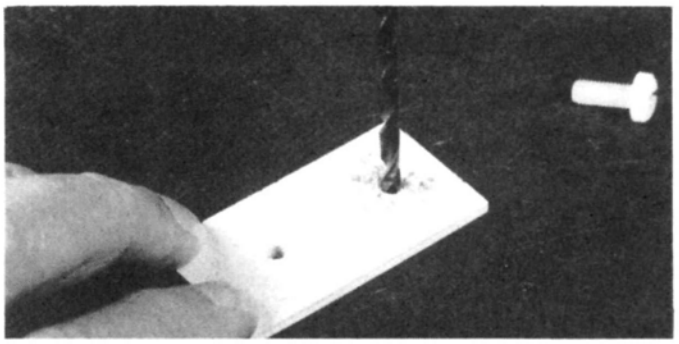
1. *The materials required are a nylon bolt and a machine screw of the same size and thread—in this case, a 3/16-inch (10-32) nylon bolt and an AN-3 (10-32) aircraft bolt.*



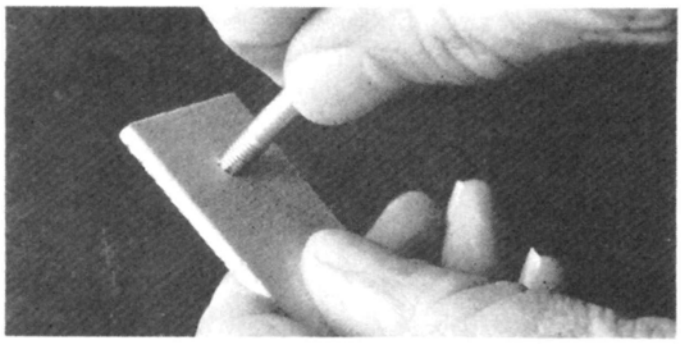
2. *Chuck the metal bolt in a vise so that it's at a very shallow angle to the jaws. Use a triangle file or, as in this case, the edge of a mill bastard file, to file a notch in the bottom seven or eight threads of the bolt.*



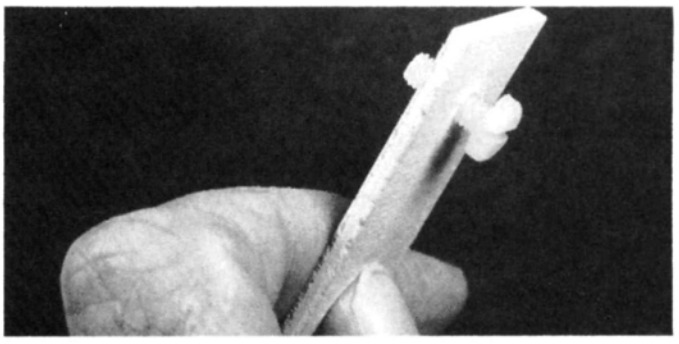
3. *The finished notch should have smooth sides and sharp edges. This tap will be for plywood. To thread hardwood blocks, a bolt with threads long enough to reach through the block should be used.*



4. *Through the part to be threaded, drill a hole that's 1/32 inch smaller than the diameter of the bolt. For this 3/16-inch bolt, the hole is drilled with a 5/32-inch drill bit.*



5. *Slowly twist the tap all the way through the hole. For deep holes, a wrench might be needed after the tap has been started. In some materials, a drop of thin CA might be allowed to soak into the hole before threading.*



6. *The threaded hole easily accepts the nylon bolt. In this manner, a tap can be made to fit any size of nylon bolt that's currently available. Total cost: about 75 cents each, including tax!*

WACO "E"

(Continued from page 16)

directly over the plan. Line up the center-section piece of the spar and pin it down flat on the plan; then fit the end pieces of the spar to the center piece with 5-minute epoxy and pin those down flat on the plan, too. Now take two pieces of the scrap 1/4-inch spruce (3 1/2 inches long) and pin one piece up snugly on each side of center section between the 1/16-inch plywood spar braces to act as a jig for all the spars. Although the top wing spars are longer than those in the bottom wing, they all have the same dihedral angle. With 5-minute epoxy, glue the 1/16-inch plywood spar braces to the exposed surface. When the epoxy has cured, lift the spar out of the jig, turn it over, and glue 1/16-inch plywood braces to this side. *Don't* remove the jig pieces until all the spars have been finished.

Bottom Wing

All ribs are made from the same rib pattern. The two nose ribs at the dowels in the center section are cut off the basic rib, and the two tip ribs are also cut from the basic rib to fit the locations. On the end rib (No. 5), cut the three spar notches 1/8 inch deeper. On No. 4, cut the three notches 1/16 inch deeper. On the four ribs (No. 1) that go at the dihedral break, widen the notch 1/16 inch on each side. On the three ribs in the most central of the center section, cut the trailing-edge end to fit snugly to the 1/4x1-inch trailing-edge stock hold-down reinforcement.

Pin the center section of the front spar accurately over the plan. Use the five center-section ribs to accurately position the rear spar and pin it down. Glue the five center-section ribs in place, then the 1/4x1-inch trailing-edge stock, followed by the 3/8x3/8-inch leading edge. Put a pin through each spar just inside the right center-section rib. Remove the other pins. Use several ribs to line up the rear spar, and pin it down out to the wing-strut-fitting rib. Double-pin both spars inboard of the strut-fitting ribs.

Using a piece of scrap 1/8-inch balsa, to be sure of the thickness, block up the tip ends of both spars, as this will give you the proper taper of the wing tips. Glue all the ribs into place, and then the leading edge. Remove all the pins, apart from the two you put in the center section. Pull the center section down to the plan, and put a pin in each spar just inside the left center-section rib. Remove the pins in the right end of the center section. Pull the left end spars down and follow the procedure for the right panel. Now pin the center section back over the plan. Block up the tips of the spars, 7/8 inch, just inside the No. 5 tip rib, and install the top spar. Glue the webbing between the spars in the center section. Lower the right panel, pin it over the plan and install the webbing, then repeat this on the left panel. Bend the top spar down into the two tip ribs and glue; also web. Now invert the fuselage and insert the two wing dowels into the holes in the bulkhead (No. F-4B). Lay two pieces of 3/32-inch balsa sheet across the opening in the fuselage—one near the trailing edge, and one near the leading edge. Trim the wing leading edge to match the contour of the ribs of the center section *only* at this point. The leading edge should be diamond-shaped with one end cut off. Lay the wing on the two pieces of 1/8-inch sheet to simulate the final sheeting, and pin it down tightly to the fuselage. (The leading edge should rest on the two dowels.) Tack-glue the dowels to the wing. Glue a 1/4x1/4-inch strip to the rib

(Continued on page 74)

Biplanes...and Still Champeen!!

by BUDD DAVISSON

IT'S A SIGHT imagined by many, but unseen by most. You, the pilot, are sitting with your feet spread wide around a control stick. The rudder pedals are somewhere ahead of you, hidden by the instrument panel, but you don't notice because your feet are the *last* thing you need to look at. Instead, your eyes are busy searching for the edges of the runway. You know it's out there, but, as the short final approaches the point where it should blend into the landing flare, the runway is nowhere to be seen. It's hidden somewhere ahead, behind the massive array of wires and parts that congregate in the middle of your vision.

Only if asked will you notice the wing that caps off the top of your vision. It's up there, out of the way, with a myriad of struts and wires connecting it to the fuselage and lower wing panel. None of the struts and stuff matters, because they sit up on top of the fuselage directly ahead—an area useless to you in the landing mode. Between the engine, the fuselage, the windshield combing and the instrument panel, "ahead" doesn't exist. As you land, the only world you see is 320 degrees out to either side. An 18-wheeler could be dead ahead and you wouldn't know it; but, as you make the turn onto final, the last thing you do is check the runway for 18-wheelers. It's a habit.

All this time, you've been peering through a small triangle on either side of the fuselage—the area framed by the windshield posts, the fuselage sides and the landing wires. Suddenly, the edge of the runway pops into the right triangle, followed almost immediately by the edge on the other side. Now you know *exactly* where you are and have an instant or two to slide the airplane sideways a little to even up the triangles, putting the airplane directly in the middle of the runway.

At that point, if you've been doing this for a long time, you stop looking out the sides. Your eyes point straight ahead, staring into the nothingness of the blind spot ahead, while your mind focuses

***Strapping** one on can have as many variations as the sounds on MTV, and to many, can be many times more entertaining!*

PHOTOS BY BUDD DAVISSON

Any way you look at it, biplanes are enchanting, exciting and frequently both. Around the clock from the left: Staggerwing Beech, flat-engined Jungmeister, "round-motored" Jungmeister, the dragonfly-like Grand Rapide, the WW I late-comer Nieuport 28, a pair of Stampe SV-4s and the Stearman. Interestingly enough, all these have been modeled by R/Cers.

on the pictures presented by your peripheral vision. Gently, your right hand eases the nose up, leveling off several feet in the air, the height of the plane being gauged by the mental computer that connects your hands with the triangles in your peripheral vision. Then you play a game with the ground and the airplane. The game is to keep the airplane off the ground, but never more than a few inches from contact. When your mental computer senses the airplane trying to settle, it tells the right hand to increase pressure on the stick, so adding a fraction of a degree to the angle of attack.

As the game continues, the angle of attack creeps up and the speed creeps down. All this is happening in seconds; it's compressed into that wonderfully alive time where the pilot is orchestrating the reunion of the airplane with the ground and wants it to occur at the slowest speed and in the gentlest manner. Without realizing it, you play with the ground, constantly adjusting the airplane's attitude to allow the wings to be exactly level and the nose pointed exactly ahead, when the flight goes out of the wings and it becomes a ground-bound object. The stick is moving in an almost imperceptible dance, as you pressure it one way or the other, instantly reacting not to only what your eyes are telling you, but to what the pressure on your backside says. The rudders twitch and instantly cancel out any deviation from the directional path. Experience has taught you that touching down any way except perfectly straight leads to a series of swerves, the severity of which is directly related to how adroitly your feet can do the tail-dragger tango.

The most satisfying of all biplane landings are on grass. If you've done your job right and held the airplane inches off the turf, the pending landing will be announced by an unheard, but clearly felt, "whishing" sound, as the wheels find the tops of the grass long before they touch solid ground. Then, almost heaving an audible sigh, the wings

lose that last necessary bit of lift and the airplane settles into the grass, decelerating almost immediately.

But the landing is far from being over. Although it's slowing quickly, any tail-dragger worth its salt would just as soon taxi backwards and you constantly scrutinize your sight triangles for any changes that indicate the airplane is trying to turn. And it *will* try many times before coming to a halt. In fact, on most, there's a point as the wind is going out of the tail and the airplane is still a little light when the machine will try to swerve. Generally it is a couple of quick, furtive little excursions to the side, as if the airplane is testing to see if you're awake. If you are, it settles down again; if you aren't, your feet will be doing battle with the airplane until it is absolutely dead stopped.

Taxiing in a biplane is almost as much fun as flying it. It's on the ground that the archaic nature of the machine catches up with you. It's impossible to see what's on the taxiway ahead, so you snake ahead, constantly S-turning. First you look out one side, then swing the nose and peek out the other. Back and forth go the nose, the tail and the feet. All this time, you can't help but notice the wires and wings that appear to be everywhere ahead. During flight and landing, they aren't as noticeable, because your eyes are focused past them. In fact, it's interesting how little of the airplane the pilot sees during landing, even though most of it is directly in his vision. He's trying desperately to develop visual references and, in so doing, fixes on what he can see and ignores what he can't. Once on the ground, however, wings and wires pop out everywhere, and that's when he realizes he's in a bipe.

Another time the pilot is biplane-sensitive is on saddling up. Depending on the size of the airplane, he'll step up on the lower wing, generally steadying himself by wrapping a hand around a wire or

Harry Shepard pilots Ernie Moser's Taper-wing Waco over St. Augustine, FL. Kits are available for R/C versions of this beauty.

The Grumman F3F (G-32A); the last of the biplane breed from the Bethpage Ironworks and the last flying example of an era long past. This shot of this extremely rare biplane was taken just before its demise.

the handholds in the back of the center section. Then the right leg is swung over the cockpit side (biplanes are *always* boarded from the left, like a horse) and planted directly in the middle of the seat/parachute. There's no place else to put it. Then, standing on that leg, the left one is brought inside to be placed on the foot trays that lead up to each rudder pedal. Placing both hands on the sides of the cockpit, you slide down inside, lowering slowly as your feet slide forward to the trays and your butt slides down the back of the seat.

Once inside, regardless of the airplane, you're very much aware of being down inside a hole, your head poking out prairie-dog fashion and your vision cluttered with biplane parts. Some bipes are worse than others, but all work to engulf the pilot and surround him with vision-obstructing parts.

More than any other type of airplane, each biplane each has its own personality. A Cessna flies like a Cessna, a Piper like a Piper, but each bipe has a character unto itself.

There is, for instance, nothing (repeat, *nothing*) like a Jungmeister. For one thing, the smallish cockpit is accentuated by the swing-up "doors" that fold in on the pilot, forcing him to feel like part of the machine. The 'Meister also has some of the best visibility of any bipe, because the pilot sits high in the fuselage. But it's in the air that the Jungmeister is the best. Possessed of a great combination of controls, the machine is civilization at its finest. A positively obscene relationship exists between pilot and airplane which results in a joyful experience for both. Because of that, the airplane absolutely refuses to fly right-side-up. Besides rolling like it's on rails, the Jungmeister invented the precise snap roll. With almost no technique required, it's possible to get quarter snaps in either direction, and it starts and stops snaps like it's digitally controlled. On landing, it's a simple matter of driving down to the runway, closing the throttle and waiting until it sighs into the grass. Obscene! Positively obscene!

And then there's the Pitts Special. This is where the word "uncivilized" came from; it's also the definition of "performance." The exact opposite of the gentlemanly Jungmeister, the Pitts tests the pilot every time he straps it on, but it never fails to take his breath away with its performance. Simply doing a takeoff is an experience, since it feels as if you're holding on to a dragster with one hand and you're being dragged down the strip! Straight up, straighter down—the Pitts doesn't care; in fact, it doesn't even recognize changes in flight attitude. It's just as happy in knife-edge as it is going straight up. It asks the pilot to work only a little at his technique, but once he's caught up with the airplane, he'll always look at biplanes as two categories, with the

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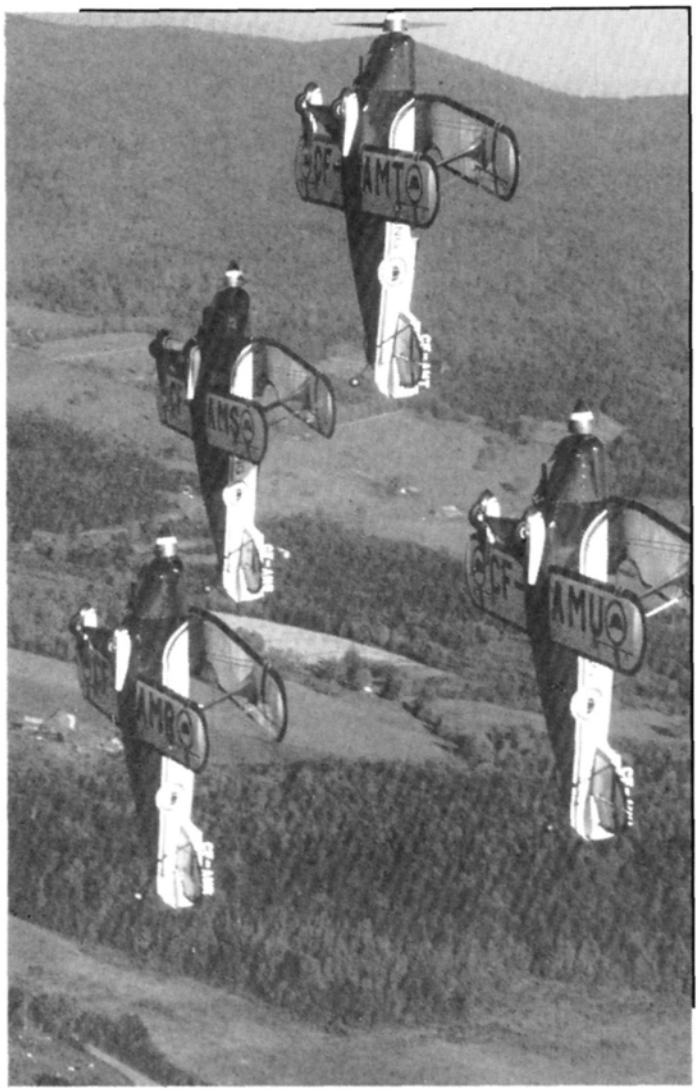

The Pitts "S" series has long been a favorite mount for many aerobatic teams. Its performance and agility are virtually unmatched in the biplane world.

Pitts in one and everything else in the other.

The really old biplanes, e.g., the Travel Airs, Waco 9s, Challengers, etc., are enormous storage units for lift. Tether them to a fence post in a good Oklahoma wind and you could fly all day for free—if you don't mind not going anywhere. Even without the fence post, most of the big bipes of the 1920s weren't going anywhere—90mph was lightning fast to them—but they have an undeniable grace about them. Representatives of the innocent age of aviation, they were the springboards upon which all of aviation was launched.

The really, really old bipes are best typified by the Curtiss JN4D Jenny. One flight in a Jenny will give you two things: a tremendous appreciation for what those original barnstormers and airmail pilots did, and an even bigger appreciation for airplanes of a later day. If the Jungmeister defines civility and the Pitts performance, then the Jenny defines "drag" and personifies "archaic." The Jenny is an example of a kinetic form of wire sculpture; it's a machine that flies. It's a testament to man's ability to figure out how to get into the air and to his patience in building small parts.

The Jenny depends on relatively light weight and huge lifting surfaces to fly, since the anemic, wheezing, 90 horses in the OX-5 don't help much. Size and weight are usually mutually exclusive concepts—something the Jenny overcame by relying heavily on a wire-braced, featherweight structure. The result is that even the ailerons have kingposts with wires running up to them. The structure is light, but the wires produce so much drag the airplane has to be flown to be believed. On takeoff, the first question is, "The throttle's forward, so where's the power?" (The second usually has to do with the odds of clearing the trees at the end of the runway!) The landing is actually the logical conclusion of flying close to the ground and killing the throttle, since it climbs, cruises and glides at about the same number. Jenny was first in many, many categories, but I doubt she won many dance contests.

We have 86 years of biplanes behind us, and it's doubtful if they'll ever go completely out of production. The aerobat, the ag operator, and the nostalgia freak will always want a biplane. And there will always be someone there to supply it. ■

WACO "E"

(Continued from page 65)

and bottom of the dowel, keeping the dowel straight.

Remove the wing from the fuselage. Glue a 1/4x1/4-inch strip to the rib and the top of the dowel. Cut the half rib to fit, and glue it to the dowel and 1/4x1/4 strip.

Add all leading and trailing edges, along with the center-section sheeting. Capstrip the strut-fitting rib with 3/32x1/2 inch balsa, and all the other ribs with 3/32x1/4-inch balsa. Fit the wing-tip blocks, glue them into place, carve them to the curvature of the wing tip, and sand them to finish. The wing-strut fittings can be bent over when you're getting ready to fit the wing struts.

Top Wing

Take a piece of 3/4x2x25-inch balsa, and rip two 5/8-inch-wide pieces for the leading edges. Rip a piece of 1/4-inch plywood 1x8 inches long for the center-section leading edge, and cap both edges with 1/8x1/4-inch balsa. (These balsa caps are easier to sand than plywood.) Cut the center-section ribs to fit their respective positions as well as the tip ribs. Assemble the strut-fitting ribs without the metal fittings, which will be glued in later. Cut the center-section trailing-edge reinforcement block from 5/16x1 1/4-inch trailing-edge stock. Cut the wing-tip blocks from 1 1/4-inch soft balsa blocks and 1 1/2x3-inch soft balsa blocks.

Pin the spars center-section down, and build the center section first. Remove the pins from the center section, and lower the right panel spars to the plan. Line up the spars and glue the ribs into place. Add the leading edge and the flap/aileron spar to the rear of the ribs, and use the same procedure for the left panel. To get the proper fit on the wing hold-down dowels, put two pieces of 3/32x3-inch balsa sheet across the fuselage cabin area—one near the trailing edge of the wing and one near the leading edge. These act as temporary shims. Put the wing frame on top of the two pieces of sheeting. Slide the wing forward, and pin it down tightly to the fuselage. Clamp together the two pieces of 1/4-inch plywood, the wing leading edge and the fuselage crosspiece. Mark the location of the holes on the front side of the fuselage crosspiece, and drill 1/4-inch holes through both plywood pieces. Insert the dowels and tack-glue them to the ribs.

Remove the wing frame from the fuselage. Sheet the center section first, then the end panels. Add the bellcrank blocks, which are made of 3/16x3/16-inch and 1/8x1x3-inch plywood. Add the 3/32-inch sheet for the pushrod exit, letting the pushrods extend just beyond the ribs to line up with the edges of the capstrips. Install the servo mounts.

It's easier to make an aileron and a flap together and to cut them apart when they're finished. First, taper one end of the spar on the bottom. Measure 2 1/4 inches from the aileron end, and remove 1/16 inch from the end. Mark the locations for the flap and the aileron control-horn mounting blocks on the bottom sheeting. On the sheet, mark the positions of all the ribs, then pin the sheet over the plan. Block up the tip end with scrap 1/16-inch balsa, and attach all the ribs. Cut apart the aileron and flap, sheet topside, and add the tip block. Bevel the leading edge of the flaps and ailerons, as shown on the top wing rib template. Add the wing-tip blocks, and carve and sand them to shape. Install the hinges, the servos and the pushrods. Sand the leading edge and the trailing edge to their correct shapes. Never leave any edges square; sanding adds quality to your work Install the strut fittings with epoxy.

Finishing and Covering

Sand all the surfaces smooth, then final-

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WACO "E"

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sand with 320-grit paper to prepare them for MonoKote*, or a covering of your choice. I covered both of my models with white MonoKote, used red MonoKote trim sheet for the trim and the registration numbers, and thin strips of black MonoKote for the door outlines.

When putting on the trim, I get the best results by first using the MonoKote trim-sealing iron on a *low* heat to seat the trim. It's much easier to keep the bubbles out if you first use a low-heat setting, and you can go back over it with the iron on high. Work the iron from the center of the trim out to each side.

The cowl is painted with K&B* Super Poxy paint. To get a smooth, well-sealed surface, the landing gear and the wheel pants are first given four or five coats of nitrate dope and then finished with K&B Super Poxy. The red stripes on the pants are cut from red MonoKote and applied using a low heat. The registration numbers on the rudder are stick-on letters found in office supply stores and department stores.

Performance

I used a Futaba* 7FGK AM radio with five servos. Both of my models balanced out perfectly without having to add weight to either end.

Like all Wacos, with their generous dihedral in both wings, the model is very stable when airborne. It's positive on all controls, and it's capable of most maneuvers—some of them probably not prototypical. It also looks very realistic when it's flying.

The first of my two "Es" took two or three flights to get it trimmed out, but the second was almost perfectly trimmed on its first flight, and I needed only just a touch of elevator The flaps work very well when used in concert with the proper down-elevator trim, and with full-down flaps, landings are very gentle.

I've used an O.S.* .90 FSR 2-cycle engine with a 16x6 Zinger* prop, and this combination has performed flawlessly. I use a J'Tec* "down exhaust" muffler with two aluminum tubing extensions to bring the exhaust beyond the cowl.

I hope you'll have as much fun building and flying the Waco "E" as I did. Good flying and happy landings!

**Here are the addresses of the companies mentioned in this article:*
T&D Fiberglass, *30925 Block, Dept. 4E, Garden City, MI 48136.*
MonoKote; *distributed by Top Flite Models, 2635 Wabash Ave., Chicago, IL 60616.*

(Continued on page 81)

ACE 4-120 BIPLANE

Sun glinting off bright yellow wings, the Ace bipe slips the surly bonds on its maiden flight. Could be any Air Corps training field in the early '40s.

PHOTOS BY ART SCHROEDER

VARIABLE "PERSONALITY," WIDE PERFORMANCE RANGE BIPLANE THAT EVERYONE SEEMS TO LIKE

by ART SCHROEDER

FOR MORE THAN TWENTY YEARS, I've reviewed model airplane kits from simple, rubber-powered aircraft to sophisticated ducted-fan machines. I've built and reviewed more than 55 offerings from an industry that helps sustain our hobby/sport activity, and I can tell you that no previous project has given me more pleasure and satisfaction than the Ace* 4-120 biplane.

That pleasure and satisfaction came from constructing a solidly designed airplane from a kit of well-prepared parts. Was this the long-sought perfection in a kit? Definitely not—but on a scale of 10, the 4-120 bipe surely scores an eight!

Ace has been in the radio-control business for over 35 years. Initially, the Missouri-based firm offered electronic kits, finished equipment and parts, and they still do. Several years ago, Ace expanded into the kit field. The business has prospered over the years and Ace has garnered a fine reputation with modelers worldwide for quality, reliability and service at a very fair price. This has been an Ace hallmark for years and it is continued in the 4-120 biplane.

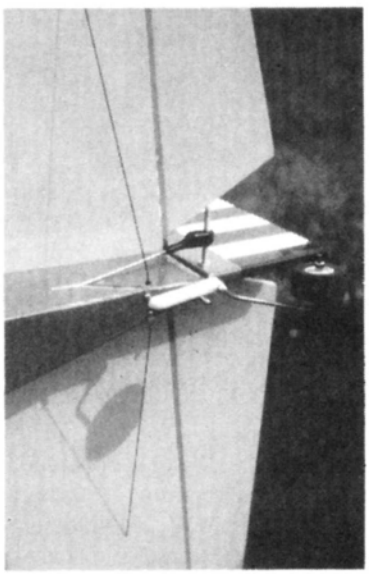
But no company, no matter how reliable, can produce a quality model airplane kit without a good designer, and Ace has found one in Dr. D.B. Mathews. I've known Doc as an editor and reader for many years, and he has reached a designer status that very few achieve. A Mathews design seems to always include simple, well-conceived construction with a clever trick or two, solid aerodynamics, neat appearance and outstanding "flyability." His

SPECIFICATIONS

Type: *Biplane*
Wingspan: *Top, 70 inches; bottom: 62½ inches*
Wing area: *1624 square inches (11.28 square feet)*
Weight (review airplane): *12 pounds, 12 ounces*
Wing Loading: *18.09 ounces per square foot*
Length: *61 inches*
Power: *Saito 120 4-stroke*
Propeller: *16x6 and 15x8*
Construction: *Poplar lite-ply and balsa*
Comments: *Well-thought-out, very flyable design that won't present many problems, even to builders with limited experience. Kit quality was good; balsa used for ribs was inconsistent.*

designs have a quality that isn't found in most kits: They can be built by hacker or expert alike with equally fine results, and they're easily duplicated! Hal deBolt has that knack, so does Bill Effinger, Bill Northrop, Claude McCullough, Hank Struck and Joe Bridi (just to name a few). D.B. Mathews is in this class, and his 4-120 bipe is a big biplane suited to everyone.

THE KIT: The 4-120 bipe kit includes everything except powerplant, wheels, motor mount, covering and adhesives. Its hardware supply is one of the most extensive I've ever seen, although there are some shortages in parts count. I also found some shortages in the wood supply, but my 4-120 bipe was a very early kit, and I'm sure this has been corrected. An outstanding landing gear of reinforced fiberglass is also included—a big improvement over the typical aluminum gears. The instruction book is well-written and accurate; the steps are clearly described in words and photos—no changes are needed.



Rudder/tail-wheel linkage uses a tiller-bar arrangement, rather than the more conventional horn. Note reinforcing rigging wires.

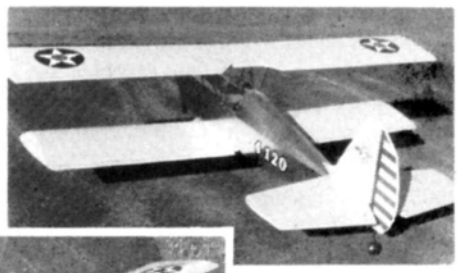
Poplar plywood (or lite-ply) is the basic construction material; spruce is used for spars and stringers, and balsa for ribs, leading edges, sheeting and other applications. Some block balsa is supplied for the cowling and main fuselage hatch, and all wire parts (cabane, tail-wheel strut and aileron linkage) are pre-formed.

A major problem I encountered was in rib die-cutting. There were several sheets of balsa, die-cut for ribs, that ranged from pulp wood to hardwood, and they didn't die-cut the same. The medium to hard wood provided clean parts, but the pulp

Ace 4-120 Biplane

READER'S REPORT

by Ron Michael



AFTER READING THE January Editorial in Model Airplane News, I decided to answer the request for opinions on products. I've had a 120 4-cycle engine for some time and recently purchased an Ace 4-120 Bipe kit that I felt would be a good combination with it.

This kit was good value for the money spent, and Ace's plans and instruction booklet do a good job of leading one through the building sequence. The fuselage is built quickly with exteÅnsive use of lite-ply and spruce, and lite-ply is also used as a core for all the tail surfaces, which are then laminated with balsa on both sides. Hinge pockets are already in place when building is completed. The resulting fuselage and tail surfaces are quite sturdy and accurate, but slightly on the heavy side. I don't feel the additional weight of the lite-ply and spruce (instead of balsa) will hinder the flight performance.

Wing assembly is pretty straightforward for a built-up wing. Substituting balsa for the supplied spruce spars would save some weight at the expense of some strength, but I think the designer wanted this model to be built quickly and strongly, and he has succeeded.

The assembly of the cabane struts has been made as painless as possible, owing to the use of pre-bent wire and the supplied lite-ply jig. I thought the struts should be made of heavier material, as the 5/32 wire is slightly springy. The top wing is quite a chunk of flight surface, and this will load the struts heavily during some maneuvers. Minus fuel, the model's total weight is approximately 131/2 pounds.

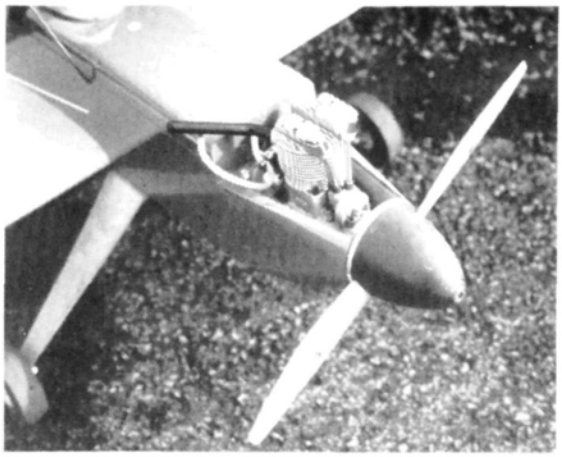
The kit's hardware package is excellent and includes a very nice main landing gear made of resin. I used all the supplied hardware, except the 1/16-inch wire pushrod in the top wing where I substituted Sullivan Gold-n-Rods.

I personalized my 4-120 Bipe by making minor cosmetic changes that were easily done. This kit was easy to build and, although I have yet to fly the model, I expect it to perform well. ■

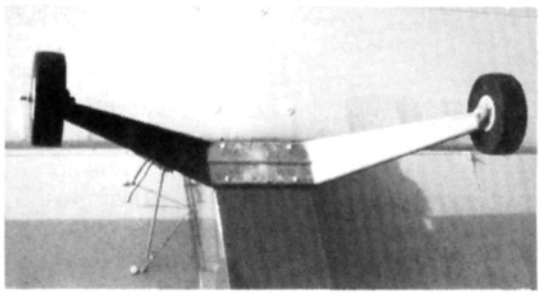
ACE BIPE

wood gave "die-crushing" a new meaning! Usually, I would have replaced the crushed parts, but I was able to clean them up enough to use them, so I pressed ahead.

The instructions warn that lite-ply parts have a tendency to warp, and that's one of the most accurate statements I've ever seen in a set of instructions! Some lite-ply parts in the 4-120 bipe kit were nearly unusable (e.g., wing tips and fuselage top formers), as they had assumed a nearly half-moon shape. After playing with them for a while, I found that clamping them together with strips of 1/4-inch spruce would pull them into proper alignment before gluing them into place; it all worked out fine. I hasten to add that all the parts were super-accurate in terms of fit and that the completed 4-120 bipe in the photos has only Ace parts in it.



Nose contours are faired nicely by spinner. Saito 120 4-stroke and 15x8 prop are nearly perfect for this airplane, though a 16x6 was also tried. Compare with Maloney 125 installation shown below.



Kit-supplied fiberglass landing gear is far superior to stamped-aluminum units; provides nice wide track for great ground handling. Four screws provide attachment.

THE DESIGN: Ace's 4-120 biplane shows a very conservative design approach. All its specs lead to good flight, including a generous wing area to carry the load (more than 18 ounces per square foot), a semi-symmetrical airfoil, generous moments to smooth out maneuvers, relatively large tail feathers and large control surfaces to enhance the bird's inherent stability. Flight surfaces are flown at a slight positive angle to the datum line; engine and stabilizer are set at zero. With the indicated balance point, it all makes for very stable flight. If you want to heat things up a bit, move the CG aft and use large amounts of control surface throw.

The 4-120 bipe isn't a snap-rolling fool, but it's certainly pattern-capable. It could do well in any IMAC competition with the right hands on the transmitter sticks, but, more important, the aircraft offers the appropriate performance for avid Sunday

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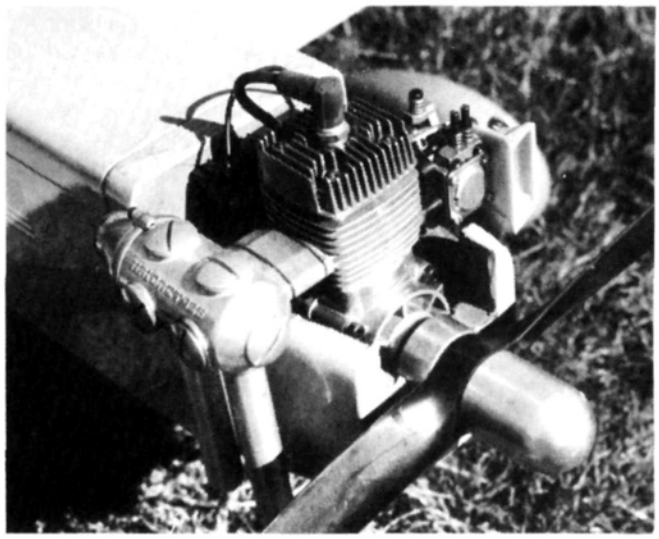
GAS-POWERED ALTERNATIVE?

DICK PURDY readily admits to both a passion and a penchant for biplanes. Truth be known, that's not exactly a unique quality among R/Cers. Dick did a review of the WMM Charger Mk.II, another biplane, elsewhere in this issue and enjoyed it. Early on in our discussions, Dick indicated that he had just completed an Ace 4/120 bipe, but had chosen to use gas power, in the form of a World Engines Maloney 125. The engine is a comfortable fit, and Dick reports that in addition to the really neat sound the engine makes, the "economy of operation" is unparalleled! Although a bit weightier than perhaps some of the available glow 4-strokes, careful placement of the radio components, especially the battery pack, still brought the CG of the completed bipe within designated limits. After flying the big bipe, Dick has concluded that, because of the overall weight and inherent drag of the airplane, the Maloney wasn't the ideal choice for the 4/120. Nothing wrong with either item singularly; it's simply a case of *too* much airplane and not enough engine. Dick recommends using a 4-stroke 1.20 to get more spritely performance. ■



WACO "E"

(Continued from page 76)

K&B Manufacturing, *12152 Woodruff Ave., Downey, CA 90241.*
Futaba Industries, *4 Studebaker, Irvine, CA 92718.*
O.S.; *distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*
Zinger; *distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.*
J'Tec, *164 School St., Daly City, CA 94014.* ■

BYRON BULLET MODS

(Continued from page 25)

allow clearance to the fuselage. If you use a Rossi .90, you must remove the upper two cooling fins for head clearance. You're probably wondering, "But won't my engine overheat?" Well, our experience in Florida's heat shows that this works.

• Next, we modified the fuel system. With the "animal" engines used in ducted fans these days, fuel consumption is high. We replaced the original 20-ounce two-tank system with a 26-ounce two-tank system, and this increased flight time by about $3\frac{1}{2}$ minutes. A 24-ounce tank is mounted at the bottom of the fuselage below the tuned pipe. We prefer to run pressure to the fuel tank, and this makes the plumbing using the original fuel valve complicated, so we substituted a Du-Bro* Kwik Fill Valve.

As with the other mod, this one, too, requires other modifications. Fueling is now simple, but how do you know when the tank is full? We make a sight glass. A small rectangular slot is first cut in the side of the fuselage, then a small, clear, fuel-line section is placed between the fuel line from the tuned-pipe pressure fitting to the tank vent. Using white silicone, this small clear section of tubing is bonded to the fuselage side across the rectangular slot. You now have a fueling sight glass!

The final modification to the fuel system is the addition of a 2-ounce fuel tank, in series, between the 24-ounce fuel-clunk fitting and the Du-Bro Kwik Fill Valve. The small 2-ounce tank is bonded to the side of the fuselage just below the canopy opening. This is necessary to prevent the siphoning effect of the 24-ounce lower tank when pulling vertical. Without the small 2-ounce tank, the engine would richen-up and flame out.

• Our next modification was to the vertical fin to prevent rudder flutter. I've had this problem, but I've also seen other Bullets that don't, and our investigation into this led us to conclude that the rudder hinge line and linkage geometry are the culprits. We replaced the original vertical fin with an extra fin that's usually used as a horizontal stabilizer for the Bullet. The rudder is cut out with the hinge line perpendicular to the base of the vertical fin. This change provides a positive linkage control that prevents flutter without reducing rudder control and performance.

• A final modification improves the aircraft's flight performance. The wing panels originally designed for the F-16 should be glassed with 1-ounce glass-cloth and epoxy resin. We found that the Bullet's increased speed and high-G maneuvers caused the aircraft to tuck, and this is caused by the flexing of the wing tips. Glassing the wing panels eliminated this problem.

Although these modifications required some major changes, we've found them worth the effort. The easier maintenance (engine modification), increased flight time (fuel-system modification) and improved flight performance (glassing of the wing panels) enable us to keep our Show Team aircraft maintenance to a minimum.

**Here are the addresses that are pertinent to this article:*

(Continued on page 82)

READER REPORTS!

We'd like you to participate in our ongoing "Reader Reports" program, which was established to give you, as consumers and our readers, the opportunity to voice your opinions on products you've used. The guidelines are easy: Just send us a brief description (three or four paragraphs) and a picture or two of a kit you've built or have underway. Tell us what you thought. If we use your report in conjunction with one of our regular "Field and Bench" reviews of the same product, we'll award you a complimentary subscription to MAN for your efforts.

It's that easy.

Participate! Make your views known.

Some of the kits now in the review process:

Hobbico Avistar 40
Century Jet Sport Hawk
Ace 120-4 Bipe
Parkinson Regal Eagle
Kyosho Concept 30 heli
CGM Sophisticated Lady
Hobby Shack EZ Dago Red
Yellow Aircraft CAP-10
Hobby Shack Extra 230
Kyosho Express electric
Tidewater Hobby Parakeet
Top Flite Elder Bipe
Midwest Aero Sport 40

BYRON BULLET MODS

(Continued from page 81)

Cloud Dancers Int'l. Show Team, *1112 Cypress Ave., St. Cloud, FL 32769. (You can write for information on performances and schedules.)*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
O.S.; *distributed by Great Planes Model Distributors, 1608 Interstate Dr., P.O. Box 4021, Champaign, IL 61820.*
Rossi; *distributed by Altech Marketing, P.O. Box 286, Fords, NJ 08863.*
Du-Bro Products, *480 Bonner Rd.,Waucaonda, IL 60084.* ■

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(Continued from page 30)

was satisfied with the scale-like performance it offered, but the changeover to the 5-cylinder, with its additional 15cc displacement, made a marked increase in performance. The difference between the Quadra with a 20x6 prop turning a little over 7,000rpm and the FR5-300's 20x8 turning a hundred or two higher is very evident: It shows up mostly in takeoff and climb, but not so much in top speed. It takes a big increase in power to make a draggy biplane go much faster.

The FR5-300 is shipped in a box of almost 1 cubic foot and includes many wrenches and accessories. The snap-on glow-plug connector leads are compact and very nicely made, but they don't fit all makes of glow plugs. The 22-page instruction booklet is very informative in every detail of operating and maintaining the engine.

For appearance's sake, I thought it was best to remove the mounting ring from the engine and to mount the engine directly to the fire wall. This approach, although positioning the engine in a more scale-like location, unfortunately makes the carburetor very inaccessible behind the fire wall. However, leaving the mounting ring on makes the engine protrude too far out from the fire wall. In a cowled installation, the mounting ring wouldn't be a problem. If you plan an installation where the carburetor isn't easily reached, run the engine on a test stand to set it up.

The engine hand-starts very easily. O.S. recommends a 10Ah battery source to light the five plugs. I didn't have anything of that capacity, so I tried two D-size Ni-Cds with 4.2Ah each, in parallel, and I had good results. An electric starter will spin the prop for those who would rather not hand-start a 3ci engine.

(Continued on page 85)

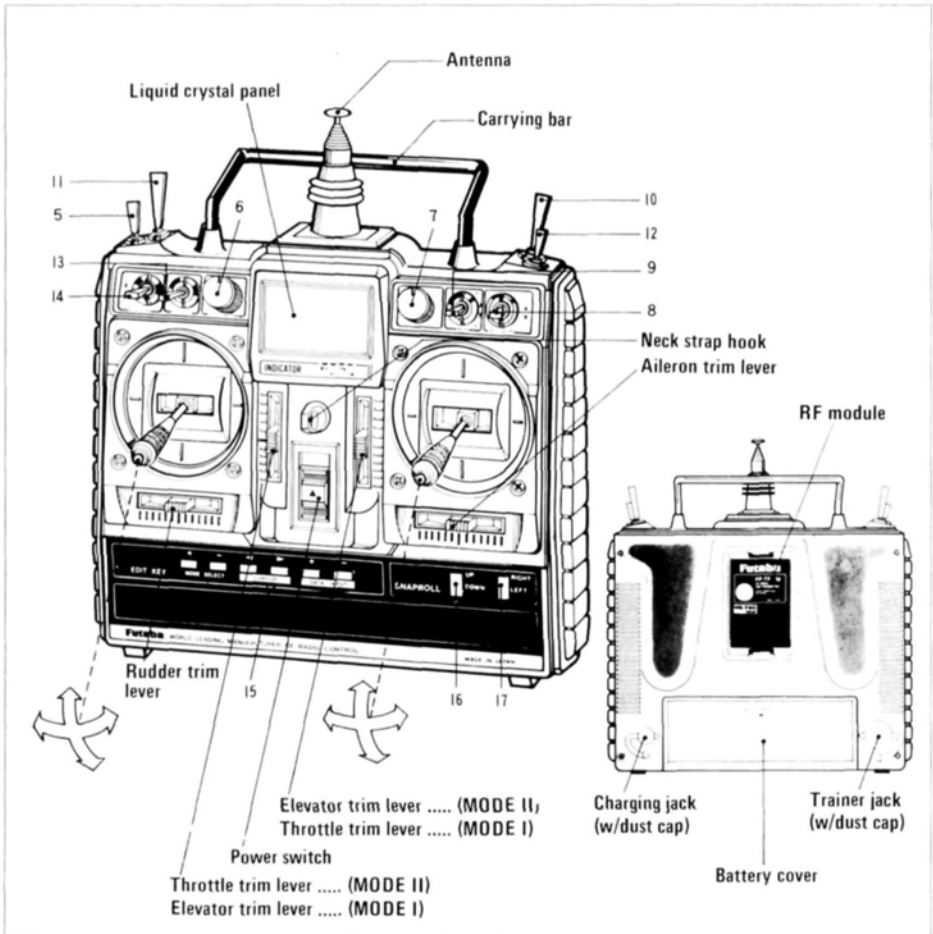
Pattern Matters

by MIKE LEE

ONE OF MODELING'S most baffling questions concerns the fuel tanks we use in our birds. Someone I met at a recent trade show asked me if having a pumped engine would solve the problem of the fuel not reaching the engine when the plane is headed downward. Of course, he went on to say that this happens when the fuel tank is only half full and the plane is diving at 45 degrees or more toward the ground. Under these conditions, his engine quits on the way down, and he's concerned about this.

Well, I haven't noticed this problem much, but I can understand some of the reasons why it happens. The most probable cause is that the questioner is flying in this attitude for a long time. I probably would have hit the ground before my fuel ran out of the feed line, but this pilot's aircraft isn't likely to be headed toward terra firma as fast as mine is. The use of a pumped engine won't cure the problem, which is probably caused by the way the clunk is set up in the fuel tank.

Most of us have read the instructions for the fuel tank a dozen or more times—mostly just for jollies. You can't deny that the instructions call for the clunk to reach to the *very rear* of the tank, and for most straight-and-level flight, this works best. However, for a pilot who flops the plane around a lot, this might not be the best place for the clunk.



In my tanks, I usually allow the clunk to reach only two-thirds of the way back to the rear, and I have good reasons for doing this. Of course, I want to prevent exactly what happens to our inquiring pilot's plane. As the fuel level goes down, when flying downward at an angle, the fuel will be parallel to the ground, but tilted in the tank. If the clunk is at the back of the tank, it might actually come out of the fuel and start to suck air. At only two-thirds of the way back, the clunk can remain in the fuel a little longer.

Further, tank assemblers often make the feed line to the clunk too long, so causing the clunk to hit the end of the tank and hang up. I've actually seen clunks stuck in the corner of the tank with the feed line crimped because it's too long. In any clunk tank, the clunk should be able to move freely without hitting the end of the tank or crimping on itself. They only work effectively when they're free to move.

Finally, there's often a mistake made with the vent or pressure line. Most of the tank manufacturers call for a length of brass or aluminum tubing to be curved up to the top of the tank to allow it to "breathe" and to allow "topping" of the tank. Very few manufacturers ever say that the line shouldn't *touch* the top of the tank. Eventually, vibration will cause the line to work through the tank wall, and you end up with fuel all over the inside the plane.

My solution to this problem is one that allows me to be very sloppy, but it gets the most out of the tank. I curve the vent line up toward the top, but I stop it short by about 3/8 inch. From there, I put a length of fuel line long enough to hit the top of the tank, plus a little. Naturally, the line will kink, but I solve that problem by cutting the end of it so that it looks like King Arthur's crown. The result is that the line can bend when it hits the top of the tank, but it can't crimp shut because of the slits at the end. Now, to prevent false fuel overflow, I'm careful to get the cuts as close to the top of the tank as possible,

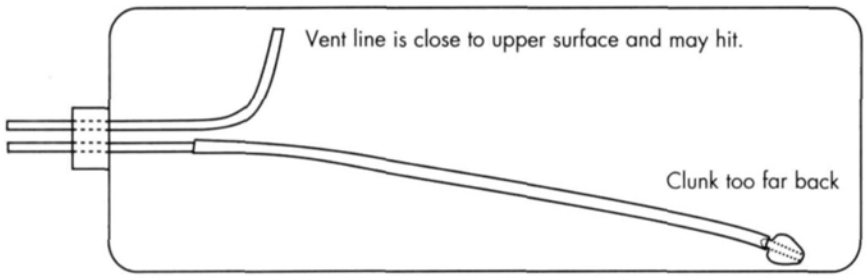


FIGURE 1

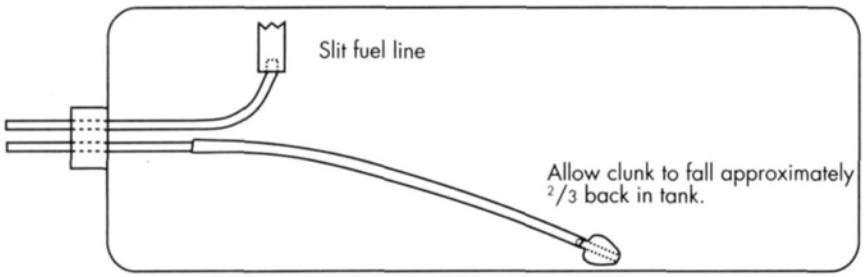


FIGURE 2

but this is simply a matter of just sliding the fuel line up or down on the vent line to meet the top correctly.

Finally, for the best possible results, get the tank level, with its center line as even as possible with the needle valve of the engine. Always use plenty of padding, and check it often for leaks or wear. By the way, did you know that, after a while, muffler pressure leaves a heavy oil residue in the bottom of the tank? Clean it out with a quick splash of alcohol, and wash your oily mess away.

Futaba Finesse

I've been able to take a close look at the Futaba* 7UAP PCM radio, and I can recommend it to pattern buffs. It's easy to program, it's extremely versatile, and it can even be adjusted to the aircraft *in flight* (with help from your caller). There are too many details to include in this column, and I can't really provide you with a "Field and Bench" review here, but do take the time to check one out soon.

Safe Stress

Back to technical stuff: A friend asked my opinion about the way someone had his wing attached to his fuselage. Sounded innocent enough, so I took a look-see. The ship was a standard Aurora 60, with the wing held on in the front by two wooden dowels, and at the rear, by a single wood screw. Now, the wood screw was pretty hefty, and it penetrated at least 1 inch into the hold-down block. I had to say that I didn't see anything wrong with this setup. My questioner said he didn't think it was too swift, as he didn't trust the wood screw to do the job. OK; let's look at this:

First, what are we doing?: We're holding a wing to a fuselage. Now, how much stress will this joint withstand before it fails? If we're talking about pure stress against the joint, the weak link will be either the forward dowels or the wood that surrounds the wood screw. I doubt that the screw itself would fail before the wood does. The most severe stress on this joint occurs during a negative-G maneuver when the force exerted will attempt to pull the wing off the fuselage. (This is true of any airframe where the wing is mounted to the bottom of the fuselage.) In a positive-G maneuver, the wing actually tries to *push through* the fuselage and, if anything, the screw or bolt holding the wing in place will loosen. Of course, the opposite is true of wings mounted to the top of the fuse.

So how much stress will the bolt, screw and/or dowels withstand before they fail? It's safe to say that most well-built sport and competition birds can withstand 7 to 10 Gs. In other words, your 8-pound bird will stress out at anywhere between 56 to 80 pounds. This isn't quite accurate, as the G-force is spread out over the airframe under stress. The stress is closer to the amount of loading per square inch of the airframe multiplied by the amount of G-stress. For example, if the wing loading is 25 ounces per square foot, then the maximum tolerable G-load would be 10.93 pounds per square foot at 7 Gs. At 10 Gs, the load would be 15.62 pounds per square foot. Now, how many square feet have you got in a wing? Well, my Tip 720 has 720 square inches on the wing. That's 5 square feet, or 78.1 pounds of stress to the entire wing under load. At least, it's a little better than before, and even at this, we're talking about the all-up weight of the bird as it relates just to the wing, rather than to the entire airframe. This means that the stress load is actually even lower.

I hope all this has taught you that the combined strength of the wing hold-down devices (bolts, screws, dowels, or even rubber bands) has to be capable only of withstanding the degree of stress to which the entire airframe is *evenly* subjected. So, at maximum stress, the wood screw that started all this should be able to take up to about 75 pounds of pull. Will it do it? Mine was able to do so for quite some time, but feeling uneasy and wondering whether it really *would* hold up, I switched to a heavier 1/4x20 nylon bolt a couple of nights after the question had been raised. Yeah, I admit it: I'm chicken!

It's Turnaround's Turn

As I've previously mentioned here, the turnaround style of flying is coming for all classes. I virtually *demanded* that the AMA change to this style to provide a training ground for future American championship pilots, and if you haven't looked at the new AMA class rules for the future, you'd better look now. The proposals for Expert Class Turnaround have already been approved. AMA-style flying is beginning to give way to turnaround styles, as the AMA style is no longer a valid pattern style outside the USA. However, as I've said before, don't trash your AMA bird, because it can, and will, fly the new style with fine results. Pattern is on the move once again, and despite having larger ships with slower props, you can still get on the pipe and airborne. Keep the faith and fly!

**Here's the address of the company mentioned in this article:*
***Futaba Industries,** 4 Studebaker, Irvine, CA 92718.*

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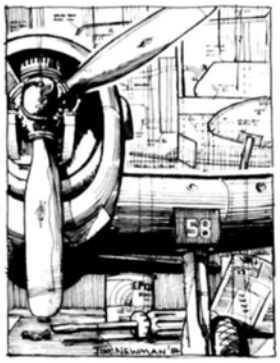
The only problem I had was trying to adjust the single carburetor to satisfy the fuel-mixture requirements of all five cylinders. It's easy to understand why all five can't be made to run correctly at all throttle settings. Glow-plug-type ignition is just too critical to allow five cylinders in five positions to be fed by one carburetor. I had trouble with the "fire" going out in the lower two cylinders during idle. It didn't happen all the time, but once they were out, I could never get them back on. I couldn't always tell if one was out until I throttled back, and the idle was very ragged, and sometimes quit, if I didn't catch it fast enough.

The engine's operating instructions state that glow heat is desirable for a dependable idle, and I agree. I spent a lot of time trying to get by without it, but just when you think you have it perfect for the next flight, it's off again. You can install a throttle-operated switch and battery to turn the power to the plugs on or off. This is inexpensive and works pretty well, but if you want to go first-class, consider the McDaniel R/C Inc.* high-tech On Board Glow Driver. This custom-built electronic device plugs into the throttle channel along with the servo (a Y-connector is required). On/off power to the plugs is electronically adjustable to any desired throttle setting, and stainless-steel PlugLock connectors with 18-inch leads are included. It's powered by a 4.8V 1.5Ah battery pack. An A/C charger is included, and a 12V field charger is offered as an option—you'll

(Continued on page 91)



Sporty Scale Te

by FRANK TIANO

REMEMBER LAST MONTH'S column, in which I suggested that you think of things you'd like to have, make a list, and send it to me? Well, I was telling a few guys at the Condor Flying Field about my idea, and one thing led to another, and before I knew it, ideas were flying all over the place. One of the best came from this English guy who has been flying R/C scale models since before the days of reeds (remember?—that's when they used those huge rhadovac tubes with the unobtanium filaments for power!). Anyhow, this guy says, "When do you think these smart radio manufacturers will get with it and design a radio for us scale enthusiasts?" That started a three-hour discussion on what we'd like to see in a scale radio, and I'd like to pass the general ideas on to you to see if you agree.

Charlie Nelson's Waco Biplane, Scale Masters competition. Not too much rigging—easy to disassemble.

First of all, there just *must* be a market for a scale modelers' radio. I mean, after all, there must certainly be as much interest in scale-type models as there is in helicopters, right? And those guys have their own rigs. In fact, when you consider how many people attend the Byron thing *every year*, the Scale Masters *every year*, the IMAA Fly-In *every year*, the 1/8th Air Force get-together *every year*, the QSAA Fly-In *every year*, the Mint Julep, the Tangerine, the NATS, the 15 Scale Masters Regionals and the Top Gun, you'd kinda think that maybe the market was a little over-ripe for a scale-type radio.

Consider your more popular, and quite expensive, 8-channel (or more) offering that the dedicated scale modeler uses today. Regardless of brand name, all the best ones have at least two or three channels we can't use, simply because we can't get at the activating switches without removing at least one hand from the box! And all of them have at least two snap-roll buttons for which you need a double "E" degree just to figure how to dial them out. And that's exactly what most scale modelers do, right? We dial the darn things out! And there's a lot more electronics in there that we don't need.

Our suggestions? Easy! Give us a radio with nine channels (or even eight) that can all be activated without having to move our hands off the sticks. Along with the usual four functions on two sticks, we suggest putting an on/off channel—a clicker-type activator—on each stick. I'm sure the engineers can figure out how to put a switch right on the stick.

Next, on each side of the transmitter, where you usually find some sort of pitch control, put channels seven and eight; and up in the right- or left-hand corners, put an on/off toggle switch like the ones we now use for retracts. Forget the dial-type channels and forget the snap-roll buttons. Give us a radio that incorporates ergonomics; you know, something that will accommodate the human body properly! Last, but not least, get the designers of all the major radio manufacturers together and have them agree on the design approach that would result in scale radios having all the bells, whistles and switches in the same places.

Bob Wischer's Mailplane has been around for many years; still competitive—lots of rigging.

Classic in every sense of the word, the taper-wing Waco. This 1/4-scale version was flown in '82 Masters and duplicates Bob Lyjak's air-show version.

Now that I'm on a roll, how about if those same radio/electrical engineering types get together and agree to use the same connectors for their servos? Honestly, can anyone think of a detrimental aspect to *that* idea.

And how about a frequency-flag system that works, stays on the radio and looks good as well? And how about making larger battery packs standard on the 7-channel and more models? I'm sure there are scads and scads of other ideas; just jot them down, mail them to Lt. Stunning, care of this here mag, and we'll pass them on to the people who care—or, at least, to those who will listen. Remember: Together, we have a pretty loud voice!!

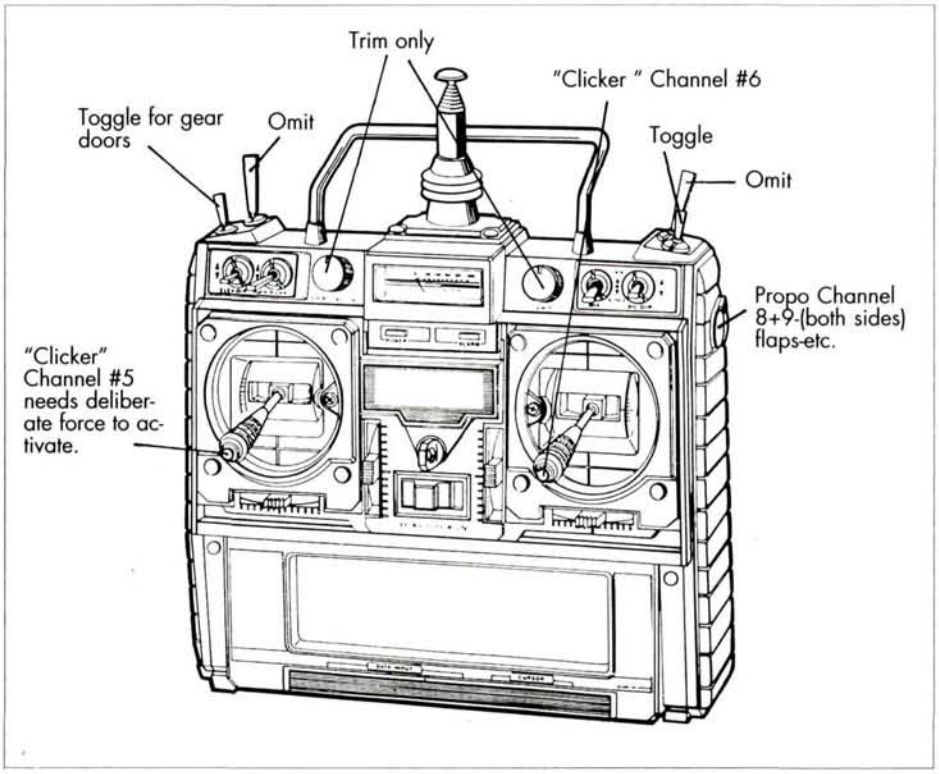
Bipe Hype

I'm fully aware that you're reading this in a "biplane issue," so I guess it would be nice if we talked a little about some stuff with more than one wing. I really believe that a smart-looking biplane can hold its own with any single-wing airplane as far as competition is concerned. Good judges don't care *what* the subject is, only *how good* it is. In other words, a righteous Gloster Gladiator will certainly do better than a sort-of P-51. Those who saw Earl Thompson's Gladiator at the '87 Masters in Las Vegas know what I'm talking about.

The reasons why we don't see more bipes have only recently become obvious. First of all, to make a successful scale biplane, you have to get the decalage absolutely correct or it ain't gonna' fly. Second, you must get the CG right or it ain't gonna' survive flying, even if you're lucky enough to get the decalage right. And third, you must power the thing with some sort of hammer engine to overcome all the drag that just comes along automatically when you model anything with a couple or three wings or so! All too often, we see a tail-heavy biplane that staggers into the air and then sets up for a different heading every time the throttle setting is changed. Take care of those three things and you'll have the makings of a real winner. Sure, they're sometimes a pain in the phistaris to assemble, but you only have to do it twice a day. And just think of all the inherent bonuses!: no blown or leaky airlines to your retracts; struts that are always in the same place in relation to any fixed part of the aircraft, e.g., the leading edge of the wing. Rarely do you have to attempt any complicated

split-flap linkage or retractable tail-wheel engineering, and almost never do you need a hard, clean, smooth, 250-foot surface for takeoff. You can almost always use an upright engine installation, and no more than six channels are needed for scale flying. Best of all, tnere are probably 22 skillion models to choose from, either in kit form or from the "big three" plans services. Color schemes are usually plentiful and attractive, and documentation is usually easy to find. Grab a catalog from Bob Holman*, Bob Banka*, or Lyle Pepino* and drool, or get a Cleveland Models* catalog as I just did, and, for a real treat, have Ed Packard blow you up one of his old rubber-powered scale model plans. You get a re-engineered set of drawings with all the necessary parts to build some handsome airplanes.

That's about it for this month. Got to get back to work on my Top Gun airplane—only five weeks to go! Two more issues from now, you'll be reading the play-by-play report of one of the most prestigious scale contests on the planet. Stay tuned, and don't forget to check that six!



**Here are the addresses of the companies mentioned in this article:*
Bob Holman Plans, *P.O. Box 741, San Bernardino, CA 92402.*
Bob Banka, Scale Model Research, *2334 Ticonderoga Way, Costa Mesa, CA 92626.*
Lyle Pepino Scale Plans & Photo Service, *3209 Madison Ave., Greensboro, NC 27403.*
Cleveland Models & Supply, *10307 Detroit Ave., Cleveland OH 44102.* ■

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find it necessary. Systems are available for engines with one to nine cylinders at prices from about $100 to $200.

If you're serious about 4-stroke engines, this is worth looking into. We installed the 5-cylinder system in the Stearman and our idle problems went away. Let me point out that this is not a cure-all for a poorly set-up engine, but it *will* make a properly tuned engine much more reliable. Running five plugs eats up a lot of battery power, making the optional field charger a necessity. You can expect to get 12 to 15 minutes of glow time before a recharge is required. (I recharge after every flight.) The complete system weighs 8 ounces, which is a small payload to carry for the dependability it offers. It's a worthwhile after-market accessory for the O.S. FR5-300.

I like my Stearman better than ever with the Robart struts, O.S. FR5-300 and McDaniel glow driver. It performs and sounds more realistic than before. It's becoming a real favorite with the scale guys, like my friends Bud Atkinson and Bob Pitney, who are both flying the O.S. radial. Bud has one in his beautiful Ryan PT-22; Bob has one now in his Fleet, and his Meyers OTW will soon sport the O.S. radial. Some guys will do *anything* to get out of building a dummy engine! Could there perhaps be an FR7-420 from O.S. on the horizon?

**Here are the addresses of the manufacturers mentioned in this article:*
Sterling Models, *3620 G Street, Philadelphia, PA 19134.*
Royal Products, *790 W. Tennessee Ave., Denver, CO 80223*
Nick Ziroli Plans, *29 Edgar Dr., Smithtown, NY 11787.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Robart, *310 N. 5th St., St. Charles, IL 60174.*
Tower Hobbies, *P.O. Box 778, Champaign, IL 61820.*
McDaniel R/C Inc., *122106 Guinevere Rd., Glenn Dale, MD 20769.* ■

SMALL STEPS

(Continued from page 33)

my favorite SF tales.)

Tomas Hultgren's rendition of the Twin Lizzie for R/C amazes me. It's a mighty tiny airplane, but both rudders work together via a completely concealed mechanism within the stabilizer. There are no external pushrods or control horns on any of the tail surfaces, and the tail assembly is even removable for easy transportation! When you consider the size of the components (the stabilizer is a mere 2¼x12

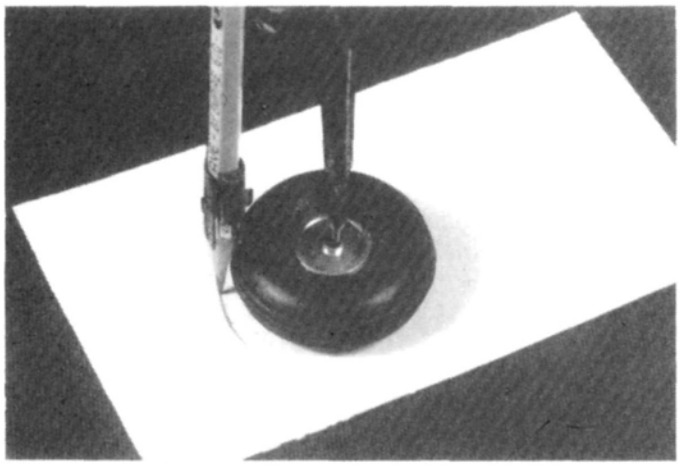
(Continued on page 97)

Custom-Made Balsa and Plywood Wheel Pants

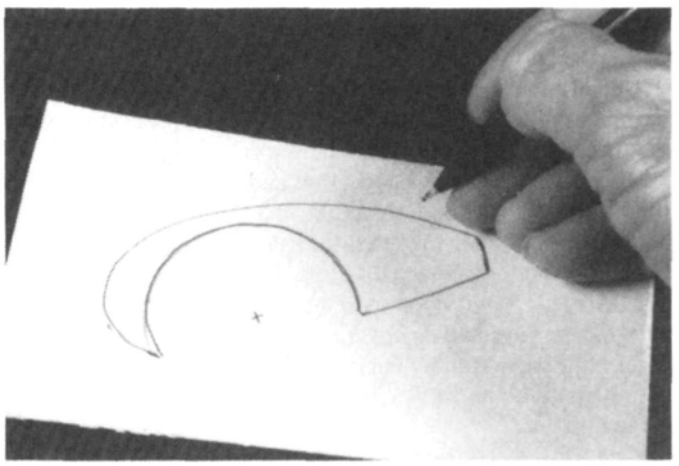
TECH TIPS

Wheel pants dress up and add a sporty appearance to nearly any model. Although commercial units are available, they might not always be the shape or size you want. This method shows you how to custom-make your own from balsa and plywood.

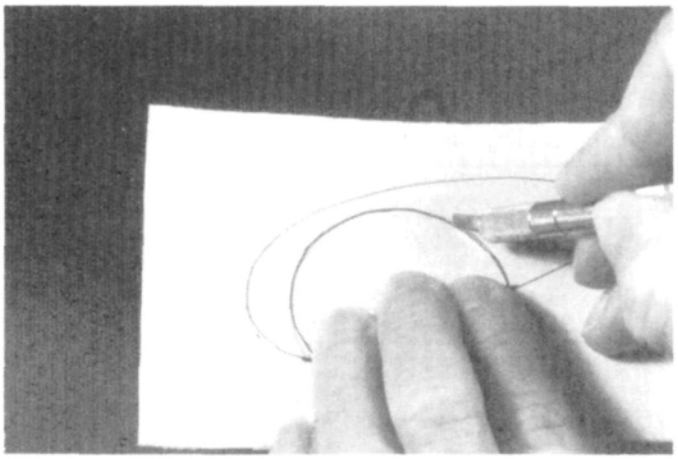
by RANDY RANDOLPH



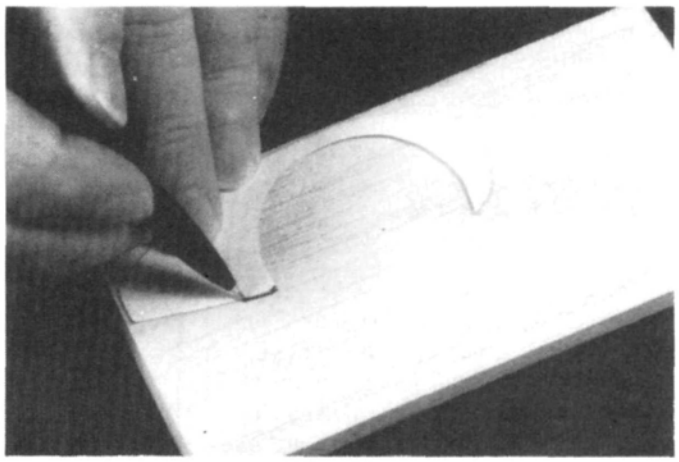
1. *Place the point of a compass through the center of the wheel hub and, on some heavy bond paper, draw a half-circle around the wheel. Allow 3/16-inch clearance around the wheel.*



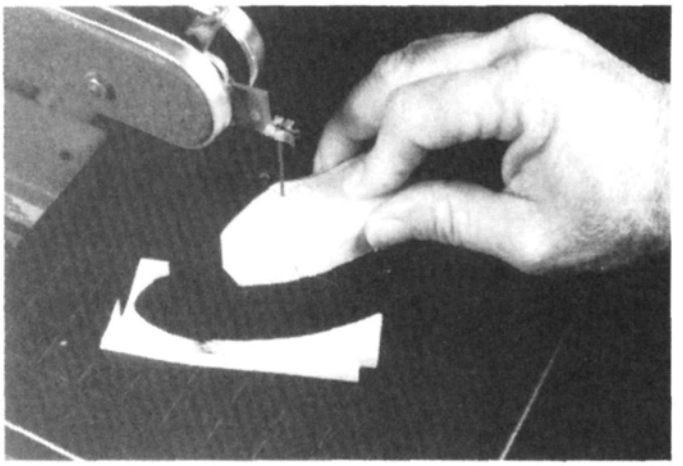
2. *Draw the shape of the pant around the half-circle drawn on the paper. The center, or axle, location should be no more than 1/8-inch above the bottom edge of the pant.*



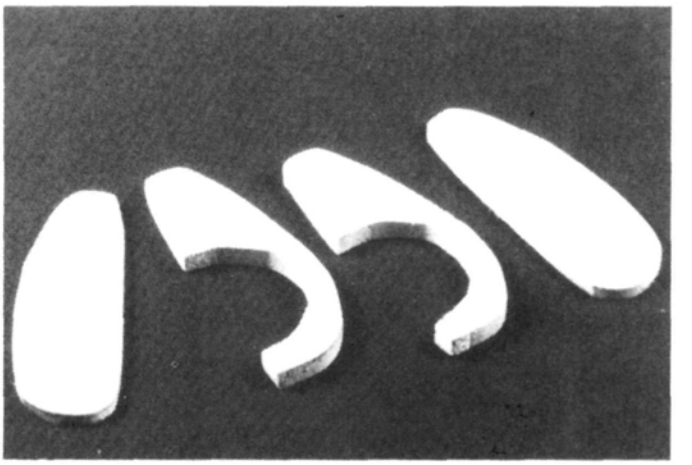
3. *Cut out this paper template. It will be used to make the inside of a balsa-and-plywood sandwich that will form the pants.*



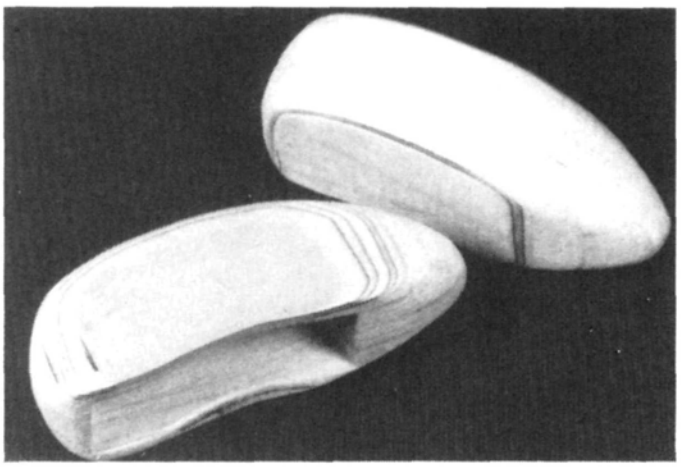
4. *Draw the pattern onto soft 1/4-inch balsa. The number of pieces needed to form the sandwich will depend on the thickness of the wheel, but you should allow 1/8-inch clearance on both sides of the wheel when measuring.*



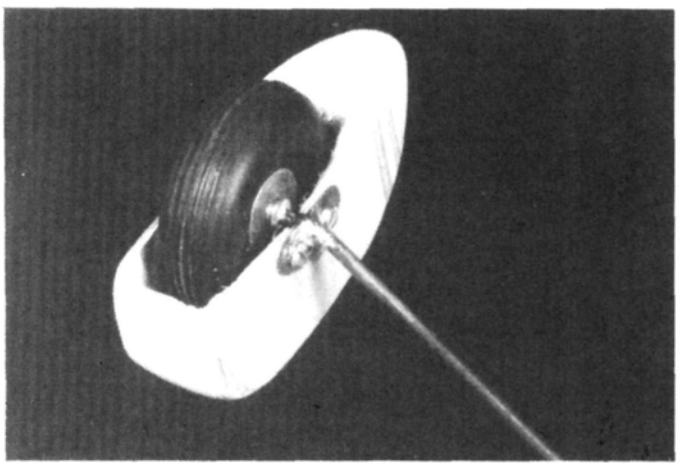
5. *If you have a jigsaw, you can easily cut out several pieces of wood at a time by stacking it and pinning it to a block.*



6. *Cut 1/8-inch plywood for the pant sides, which are cut from the same template by drawing across the wheel cutout. The plywood is used to add strength to the sides for mounting.*



7. *Assemble the sandwich and, with epoxy, glue it to shape. When the epoxy has cured, carve and sand the pants to a streamlined shape.*



8. *The pants are held over the wheels by means of a drilled metal plate that's soldered to the strut. Two small wood screws in the plywood side hold the pants in place. Epoxy-paint inside and out to protect them from moisture and oil.*

Cambridge Models

PITTS SPECIAL

FIELD & BENCH REVIEW

This Imported Pitts is Prefabricated to Get You Aresti'd Quickly!!

by CRAIG HATH

THE PITTS BIPE! No other aerobatic biplane is more well-known than this famous ship. Designed in the late '40s by Curtis Pitts, this popular design was originally intended as a home-built sport plane, and it evolved into an aerobatic ship later. The Pitts has also been a platform around which other aerobatic biplanes have been conceived, e.g., the Christen Eagle and Weeks Special, to name just two.

It's probably safe to say that this airplane holds more aerobatic competition titles than any other by a large margin, and having this opportunity to review a large-scale version of the Pitts S-2A really sent adrenaline rushing through my veins. As an ardent pattern competitor, I had been considering flying in some of the IMAC competitions that are beginning to pop up within a reasonable distance of my home, and I thought that the Cambridge Models* Pitts would be a perfect start.

Keeping this in mind, I approached the project more with a desire to build a great flying model than to concentrate on scale detail. I made every effort to save weight and improve

SPECIFICATIONS

Type: *Scale/IMAC-type pattern* **Wingspan:** *59 inches* **Length:** *57 inches*
Weight: *11 pounds (test airplane:12 pounds,13 ounces)*
Area: *1,512 square inches (10.5 square feet)*
Wing Loading: *16.7 ounces per square foot (test airplane: 9.5)*
Power Required: *.90 and up, 2-stroke; 1.20 and up, 4-stroke*
Number of Channels Required: *4 minimum*
Suggested Retail Price: *$295*
Features: *Molded fiberglass fuselage with pre-sheeted (obechi wood) foam wing panels. Molded plastic accessory parts.*
Comments: *Good quality, imported kit goes together quickly. Fuselage is laid up from fiberglass mat rather than cloth, and this results in a heavier airframe than one might expect. Properly powered, the Pitts is an excellent flying airplane.*

performance, while simultaneously trying to retain fidelity of outline and keep with a generally accurate scale appearance.

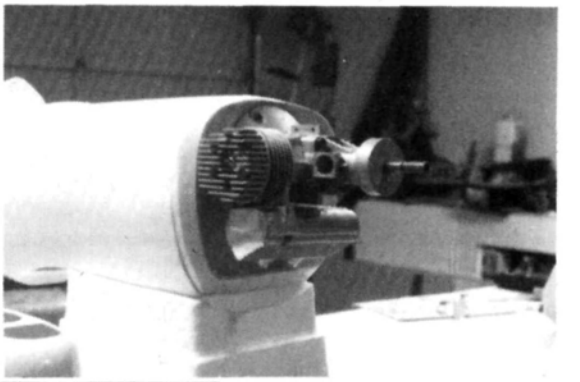
THE KIT: When the kit arrived, I eagerly opened the carton and began to inspect the contents. Everything was well-protected and in quite good condition, considering that the kit had traveled from England. First, I removed the wing panels and looked over the very well-crafted, pre-sheeted, foam wing cores. I liked the use of obechi wood to sheet the wings.

Next, I checked out the fuselage, and there I found that I had some objections. The fuse is molded of sprayed fiberglass matting, which is much like fiberglass panels on a few production cars, e.g., the Corvette. This matting is easier to manufacture, but it weighs approximately twice as much as those laid-up from fiberglass cloth sheets of the same size (the bare fuse weighs 4 pounds). The exterior finish of the fuselage was, however, very smooth and free of pinholes. (Gel-coating gets the credit for the excellent exterior fuse finish.) The cowling is fabricated in this way, too.

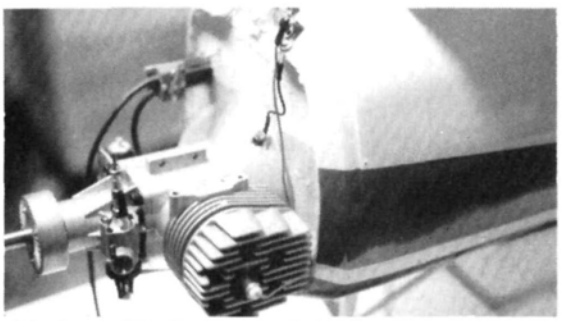
To speed the building process, kit designer Phil Ramsey makes extensive use of molded plastic parts. As well as these, you're also provided with a clear molded canopy, the few wooden pieces needed for completion (like the stab and rudder, wing leading and trailing edges, etc.), and some of the hardware required. The one-sheet plans are approximately half-size, although not drawn to scale. There's a copy of a review of the kit from an English magazine, along with the kit reviewer's written instruction booklet. Fiberglass-and-foam construction generally doesn't require very detailed plans, and those provided will be quite adequate for most experienced builders.

The plans state that the airplane can be flown using any engine from .60 up to 2000 series. I thought that I needed to be at the top of the scale and decided that I'd go with a Super Tigre S-2000, which is a 1.20 cubic-inch 2-cycle glow engine available from Indy R/C*. Through no fault of Indy's, I had some trouble obtaining the engine; at first, I received only an empty carton from UPS. Apparently, someone at UPS had acquired some new equipment via the five-finger discount method! I thank Indy for handling the problem quickly and without hassle.

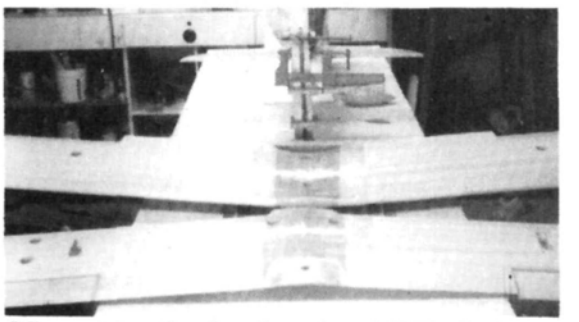
Close-up of engine installation with Tatone Pitts-style muffler fitted. The Super Tigre S2000 is a good match for this bird, but the S2500 or S3000 might be an even better choice.



One-eighth-inch brass tubing has been coiled and "siliconed" into the Tatone muffler for preheating the smoke oil. No. 2 diesel oil and automatic-transmission fluid with just a little Marvel Mystery Oil tossed in for good measure. Smoke system didn't work at first, owing to damaged pump; but it works well now.



The front of the fuselage needed to be trimmed about 7/8 inch to accept the Super Tigre S2000; a new plywood fire wall was installed floating in clear silicone RTV.

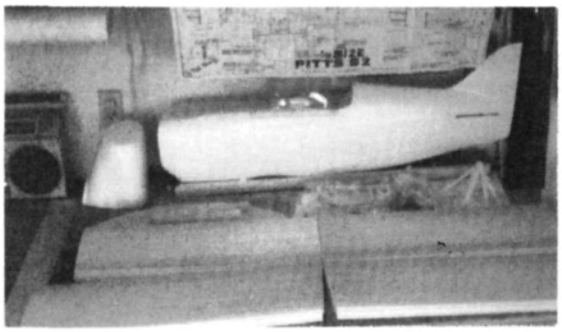


Wing center sections have been glassed. Notice the lower wing fairings added by author.

ASSEMBLY: Off to the building board. I started with the wings, as they seemed to require the most work. This was my first experience with obechi wood, and I learned that this material is superior to balsa for sheeting wings. Very thin obechi can be applied over foam, making it just about as light as balsa. The obechi used here is about 1/32 inch thick, where balsa at least 1/16 inch thick would be needed instead. Obechi comes in widths that will allow the use of one-piece wing skins, and it's very ding-resistant.

After gluing-on the leading and trailing edges and sanding them to shape, I discovered that obechi will handle the abuse of rough sanding, since, with 600-grit paper, I was able to shape the balsa right down to the sheeting with no apparent damage to the obechi wood.

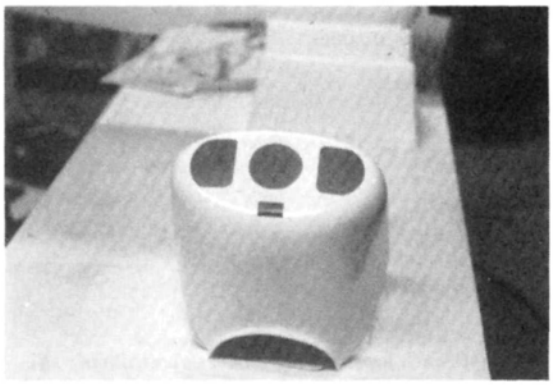
When you plan the wing construction, you have a choice of methods for driving the ailerons. Plastic bellcranks, which mount in the outer portion of the wing panel, allow the use of a single servo that's mounted in the lower wing center section. Pushrods connect the servo to the bellcranks, and, in turn, to



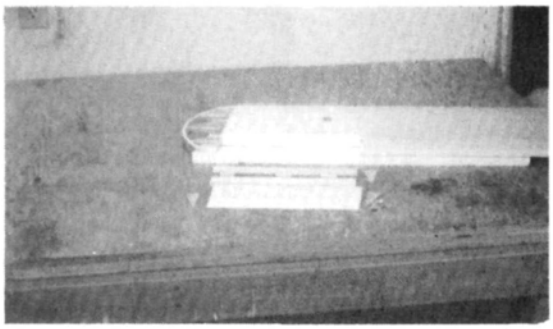
Here's a look at the kit as it arrives; wings are pre-sheeted. Fiberglass parts speed assembly.

the ailerons. You also have a choice of using a servo in each of the lower wing panels, in which case you'll have to provide your own "servo-mounting boxes." I choose to go with the two-servo system, as I think that this method is very slop-free and makes it easy to set up differential throw, etc. Be sure that you get the aileron servo set up before you join the bottom wing panels, as you'll have to drill holes through the centers of the cores to allow for servo leads or pushrods.

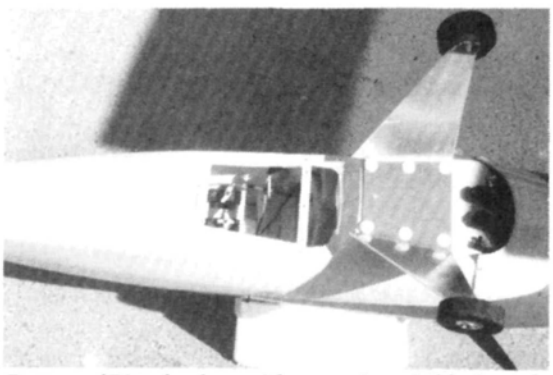
The trickiest part of building the wings is cutting out and finishing the ailerons. Be very careful to follow the adage of "measure twice and cut once." I drew each cut outline on the wing panels, and I cut over these using a straightedge and a modeling knife. Be sure that you don't twist the ailerons when you glue on the leading edges. The included plastic wing tips work out quite well and provide a strong, ding-proof finished product. I also liked the molded plastic sockets for the wing hold-down screws. Install these by drilling the small-diameter hole from both sides of the wing core using a sharpened brass tube. Then use one of the sockets, sharpened to make the large hole; this method worked perfectly for every insert. Join the wing halves and reinforce the center sections with fiberglass tape. Be sure that you get the dihedral of the lower wing set accurately, as the spacing of the wing end struts is fixed, and if the dihedral is incorrect, the wings won't match up to the struts.



Cowl openings are cut with a Dremel tool, and edges are cleaned up with a half-round file. Shape of opening was cut out of card stock and traced onto cowl, then flipped over to do opposite side.



Cutting out the ailerons can be tricky, so be sure to draw cut lines and double-check everything. Here's a layout of all the parts needed to finish the ailerons. You can save time by making up these parts kit-style.



Bottom of Pitts fuselage with servos just visible through wing cut-out. Aluminum gear secured by six nylon bolts. Silicone tubing exhaust extensions take hot air from cowling.

Next, I started work on the fuse, and fitting the wings came first. There's a molded plastic crutch that has the lower wing hold-down nuts molded in. Throw this into the trash, and replace it with 1/4-inch ply. I used the plastic piece on my kit, and I had to replace it with wooden pieces after only a few flights, because the plastic split right at the nut.

The plans don't call for any fairing of the bottom wing to the fuse, but I thought that this would be a simple and attractive modification. The fairings were made with balsa blocks that were cut and sanded to shape, and the rear wing bolt hole was supported with a piece of 1/2-inch dowel drilled to accept the wing bolt. The upper wing is connected to the fuse with molded plastic cabane struts. These parts are very good, and they'll save you much time compared with building wire ones. The interplane struts are very good, too, and they were soon finished.

There's no reference to wing incidence anywhere on the plans or in the instructions, and this was probably omitted because incidence is governed by the molded parts, and can't easily be changed. My ship set up with 1/2 degree of positive in the bottom wing and 1 degree of negative in the top wing. This seems to work out fairly well, so, for reference, you might want to check this during the alignment process.

From here I went to engine installation. Owing to the configuration of the fire-wall arrangement, I ran into some surprises in this department. The kit comes with a two-piece plastic fire wall that sandwiches around a molded lip at the front of the fuselage. This would work well if you were using a .60 or .90 engine, but the Super Tigre S2000 is a little longer and would stick out too far from the front of the cowling. I started measuring, and wound up cutting about 7/8 inch off the front of the fuse and making a plywood fire wall. In addition to this, I undercut the fire wall about 1/8 inch to 3/16 inch and set it in using silicone clear RTV. This produced a "floating" fire wall that would dampen some of the engine vibration from the airframe and reduce noise, too. Since this was an experiment, I was a little leery, but I won't hesitate to use this

(Continued on page 120)

SMALL STEPS

(Continued from page 91)

inches, with about 1/4 inch maximum thickness), you'll appreciate how truly remarkable Tomas's achievement is. I asked him how he managed it, and he sent me some beautifully drawn perspective sketches of his control hookup. I had hoped to steal his methods for use in a project of my own (say, a small twin-engine model powered by two of Peck-Polymers' new Silver Streak motors), but I'm not confident that I'm up to the intricacy of Tomas's clever system. It's mighty ingenious, though!

What I'll probably do with the 2-motor airplane (a B-25? Amelia Earhart's Lockheed 10-A? a Beech 18?—I can't decide) is leave the twin rudders fixed, and I'll fly with just elevators, ailerons and motor control. After all, with electric power, there's no need to worry that one motor might quit prematurely and make quick rudder action imperative to prevent the airplane from corkscrewing into the ground.

And, for sure, in this project, I'll use "differential ailerons" with about twice as much "up" motion as "down." With a flat-bottom wing airfoil such as is typical in sport-type R/C models, a down-moving aileron produces extra lift on its side of the wing, and extra drag as well, but the up-traveling aileron on the other wing does just the opposite. As its motion begins, both lift and drag are reduced on its side of the airplane. Thus, if left and right aileron movement are equal on a flat-bottom wing, when the airplane starts to bank one way, it might simultaneously yaw in the other direction. It's hard to fly an R/C model that has that sort of nasty habit!

But if the control linkage is arranged so that the "up" aileron moves much farther than the "down" one, the drag on both wings becomes more equal. The tendency we call "adverse yaw" is then minimized—usually to well within the self-correcting ability of a fixed vertical tail.

Until next time, keep taking that "one small step for mankind..."!

**Here are the addresses of the companies mentioned in this article:*
***Flyline Models,** 10643 Ashby Place, Fairfax, VA 22030.*
***Cox Hobbies, Inc.,** 1525 East Warner Ave., Santa Ana, CA 92705.*
***Cannon R/C Systems,** 2828 Cochran St., Simi Valley, CA 93065.* ■

FOUR-STROKE FORUM

(Continued from page 40)

there are around the engine, the more room air has to become trapped, retained

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FOUR-STROKE FORUM

(Continued from page 97)

and heated. The solution to this heat-retention problem is to move the air in and out as quickly as possible. By using plates and tubes, we can create ducts for the air to travel through the cowl, taking with it the heated air.

Now, when the air passes over and around the engine, it picks up heat, and this heated air will expand. To make the system most efficient, the passages to the exit point should be larger than those leading to the engine. Take a look at the highly functional design of some of the Formula 1 racers in which the engines are tightly cowled. They all use small entry points, good baffling and large exit points.

The carburetor should also be considered. Unlike most 2-cycle engines, which have their carburetors located in front, 4-stroker carburetors are located behind, or off to the side (e.g., the O.S., Enya, or Conley engines), but still at the rear of the engine. You must ensure that a sufficient supply of air is available to the carb. Flexible tubes, such as the clear type used to supply air to fish aquariums, can be used to deliver a fresh supply of air to the carb. Make sure that the i.d. of the tube is large enough to fit over the carb inlet. Don't put the tube inside the carb throat, because this will reduce the throat size, or bore, of the carburetor, so restricting the amount of air available to it, and it might also interfere with the movement of the throttle barrel. The other end of the tube is secured to the front of the engine compartment and open to the atmosphere. You might even notice an increase in rpm owing to the ram effect, which can loosely be compared to "supercharging."

I hope this info, along with the illustration, will help you with any overheating problems you might be having. Yes, it might take a little time to get everything set up, but while you're flying and it's 101 degrees in the shade and everyone else is overheating in more ways than one, you'll be *cool*. ■

GOLDEN AGE

(Continued from page 51)

preliminary research was extensive.

Numerous possible coders and actuators were conjured up. Each was evaluated to determine how it would fit the desired parameters. Besides providing control, the parameters included the number of controls possible, and the type of control movement. There were other con-

siderations: Should there be a neutral? What about variable movement? How many information channels were required? How much operating power would be needed, and what would be the source? The weight and even the projected cost were also considered. It's interesting that the maximum cost projection was $40 for three controls. If modern servos had been possible, the considerable expense might have ruled them out! (Three servos today can cost $125.)

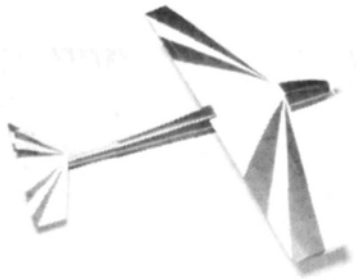
Ten actuating systems were investigated seriously, mostly based on escapement-style mechanisms or their derivatives. For each, the concept was detailed, then studied with attention to what sort of radio would be required for operation and how each compared to the others. The systems varied in complexity, from a single control with no neutral, advancing to full controls with a sort of proportional action. An objective was established: It was felt that only full controls would meet the project's ambitions, but much had to be learned and, to start, simple control would be the first step.

Remember, these people were starting practically from scratch. Once the control actuating systems were conceived, radios had to be developed to operate them. The American Radio Relay League findings would provide the basic principle, but from there, it was virgin territory. The first attempt was with the simplest control, what we'd call single-channel. The transmitter started as single-channel and, as the project progressed, it expanded to as many as four channels. The additional channels were gained by using separate RF frequencies for each. In effect, the 4-channel system was four separate transmitters consolidated into one package! The frequency range was from 56 to 60MHz. Thus, at maximum, the TX had four antennas, and it put out 50 watts power that was supplied by a gasoline engine-driven auxiliary generator. A most complex broadcast station! Compare it with your TX, which can have as many as eight channels, one antenna, a few pen-cell batteries and probably has less than 1/2 watt power!

Naturally, as the channels were added, the receiver became more complex following the TX concept. They apparently used the ARRL single-channel hard tube circuit. Channels were added by simply including more receivers. From what we can determine, it appears that the first 4-channel systems receivers were in one package, all on one board. The amplifier and relays for them were a separate unit.

(Continued on page 103)

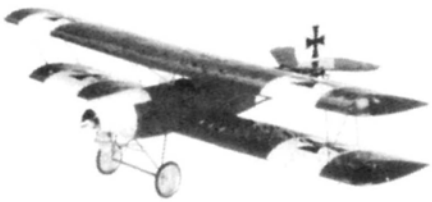
Product News



GREAT PLANES ELECTROSTREAK

Spanning 44 inches, the Electrostreak features razor-cut balsa and ply parts that can be easily assembled by following the step-by-step instructions. A new, high-powered, Great Planes Goldfire 550 motor and matched 7x6 nylon prop give predictable pattern tracking and full 4-channel aerobatics, including snap rolls, Cuban eights, inside and outside loops, spins, etc. With the new Electrostreak, Great Planes has given advanced fliers a true electric aerobatic and pattern ship

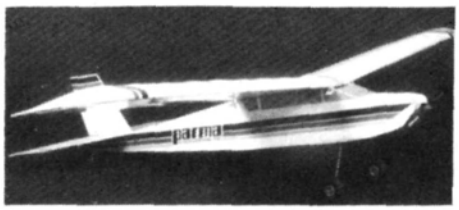
For more information, contact Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.



TOP FLITE ELDER BIPLANE

The look: classic. The performance: spectacular. The kit: pure Top Flite! As it leaves the flight line, you can almost feel the wind in your face and a silk scarf snapping in the breeze behind you. The Elder Biplane combines the thrill of aviation's most romantic era with the easy-to-build quality you expect from Top Flite. With almost 1,500 square inches of wing area, the Elder Biplane is a joy to fly. With a wingspan of 65 inches and wing area of 1,492 square inches, the biplane is 50 1/4 inches long, weighs 7 1/2 to 8 1/2 pounds, uses .45 to .75 2-stroke or .60 to .90 4-stroke engines, and requires a 4-channel radio.

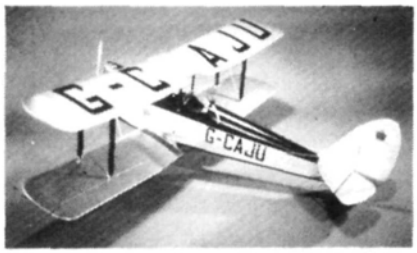
For more information, contact Top Flite Models, Inc., 2635 S. Wabash Ave., Chicago, IL 60616.



PARMA AERO-TIGER

Parma is pleased to announce the release of its first electric R/C aircraft kit, the Aero-Tiger. With machine-cut and sanded premium balsa parts, this sport/trainer design has superb performance while being stable enough for a novice! The Aero-Tiger accepts standard sub-C batteries and direct-drive .05 motors, and it's available in Basic and Deluxe kit versions at your favorite Parma retailer!

For more information, contact Parma International, 13927 Progress Pkwy., North Royalton, OH 44133.



AERODROME MODELS CIRRUS MOTH

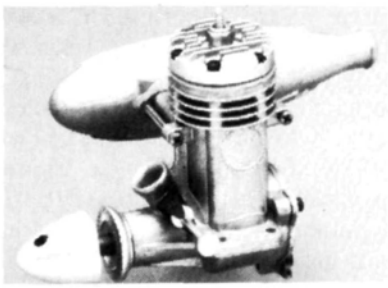
Biplanes have always had two things against them: They're difficult to transport, and your radio is trapped. The Cirrus Moth solves both problems. By simply removing four easy-access bolts, the wings fold, fully rigged, against the sides like the full-scale bipe. To solve the radio problem, an easy-access panel has been installed in the bottom of the fuselage. The kit includes flying wires with custom brass hardware and scale control elevator and rudder hook-up. The Cirrus features a 54 3/4-inch wingspan and requires a 5-channel radio system with extensions for folding wings. The Cirrus has a wing area of 845 square inches and a wing loading of 17 ounces per square foot, weighs 6.25 pounds, and requires a .25 to .40 2-stroke or a .45 to .50 4-stroke engine.

For more information, contact Aerodrome Models Ltd., 2623 S. Miller Rd., Saginaw, MI 48603.

BYRON ORIGINALS CRAFT CUDDLER

The new Craft Cuddler from Byron Originals provides both boat and airplane modelers with something they've needed for a long time: a fully portable workbench that's sturdy enough for shop use and light enough to be used in the field. The Craft Cuddler adjusts to models of any size up to 40 pounds. Soft, but strong, nylon straps attach to three different positions on the Craft Cuddler's support legs for a multitude of width and depth adjustments. The ends of these straps have Velcro fasteners that gently, yet securely, lock your craft into position—upside-down or right-side-up.

For more information, contact Byron Originals, P.O. Box 279, Ida Grove, IA 51445.



FOX MANUFACTURING FOX 35

The Fox 35 Stunt is now in its 40th year of continuous production. To celebrate, Fox is offering a 40th Anniversary Special, which features ornamentation on the bypass and a polished spinner nut and muffler. Each motor has been test-run, and there's also a redesigned box (in the same familiar red-white-and-black) that's large enough to contain the motor, spinner and muffler.

For more information, contact Fox Manufacturing Co., 5305 Towson Ave., Fort Smith, AK 72901.

W.R. BROWN HS830 SERIES AIR BRUSH

The HS830 Series Hobby Air Brushes are designed with modelers and craft persons in mind. Three nozzles are available—fine, medium, and heavy—to handle all the materials used to finish models and other hobby and craft projects. With the fine nozzle, the Hobby Air Brush is capable of a 1/8-inch line. The heavy nozzle will spray a 1 1/2- to 3-inch pattern (depending on the viscosity of the material used). The unit has a wide-bottom jar that sits upright, without the use of a special holder, on any flat surface. The size of the jar's neck is large enough to allow complete cleaning. The nozzles are pre-joined to the jars, so color or material changes are quick and easy. This has the additional advantage of enabling you to pre-mix colors and save clean-up until the end of the project.

For more information, contact W.R. Brown, Inc., 2701 North Normandy Ave., Chicago, IL 60635.

SULLIVAN SKYLITE WHEELS

Sullivan introduces a line of lightweight, durable wheels that are complete with ShurLock retaining clips.The wheels are 40- to 50-percent lighter than the best-selling brand. They have a tough nylon hub (which can be enlarged for bigger axles), low bounce and can't go flat. Skylite wheels are available in 1 3/4-, 2-, 2 1/4--, 2 1/2-, 2 3/4-- and 3-inch sizes.

For more information, contact Sullivan Products, 1 North St., Baltimore, MD 21224.

IKON N'WST SPERRY MESSENGER

This easy-to-build airplane kit brings back the fun to kit bashing. From its hand-cut parts to select wood, this kit includes nearly everything a builder needs. This little 60-inch 1/4-scale biplane is fully aerobatic at 10 pounds. Sized for .60 to .80 engines, the plane can be built easily and quickly. For beginners, this is a simple bipe with fixed cabane struts, so the top wing installation is very easy. Experts can achieve a lot of scale detail to make this a very fine project. For either, the plane is a really natural flier.

For more information, contact Ikon N'wst, P.O. Box 306, Post Falls, IA 83854.

PICA ENTERPRISES WACO YMF-3

Pica's new, 1/5-scale, Waco YMF-3 has all-balsa construction, poplar plywood dies, detailed step-by-step instructions with isometric drawings, pressure-sensitive Mylar decals, pre-formed landing gear, ABS one-piece cowling, exterior-detailing package and more. Both wings are built in three panels, with the main spars, front spars, and leading edge giving lateral structural stability. Other construction features include: sheeted leading edge; trailing edge and center sections; wire and dowel pushrods for the aileron and tail surfaces; full-length longerons glued into pre-notched formers; and much, much more. The result is a smooth flier that has excellent flight characteristics. The Waco has a top wingspan of 72 inches and a bottom wingspan of 64 inches; the total wing area is 1,530 square inches, and the fuselage is 54 inches long. The engines recommended for the Waco are: .61 to .90 2-stroke or .91 to 1.20 4-stroke.

For more information, contact Pica Enterprises, Inc., 2657 N.E. 188 St., Miami, FL 33180.

FUTABA 5-CHANNEL FM SYSTEM

Here's a breakthrough in sport-system price and performance. Now you can have a 5-channel system with extra features like transmitter RF module, ATV, dual rate and FM. Flip up the front panel cover and a full array of programming controls appears. The 5UAF provides ATV adjusters for aileron, elevator, throttle and rudder, dual rates for aileron and elevator, and servo-reversing on all channels. The new 5UAF also has a transmitter that's contoured for a perfect, comfortable fit and has adjustable, open gimbal control sticks, fine-trim adjusters, a built-in Ni-Cd pack and a carrying handle.

In addition to its advanced electronics and controls, you'll find a built-in trainer system. Using the optional trainer cord, control can be switched instantly from student to instructor. The 5UAF system is equipped with four S148 servos, which, like all new Futaba components, are assembled using wireless SMT (Surface Mount Technology) to eliminate vibration-related damage and failure.

For more information, contact Futaba Industries, 4 Studebaker Dr., Irvine, CA 92718.

CLUB OF THE MONTH

THE ANCIENT CITY R/C FLYERS

The Ancient City R/C Flyers of Saint Augustine, FL, is the *Model Airplane News* Club of the Month for June, 1989.

Owing to their more-than-temperate location, the members of this club don't have to head indoors for the "cold" season; they simply fly all year. There's no "opening day" like the one we have here in northern parts, but their season kicks into high gear in the spring months.

This relatively small club plans to hold many club picnics for the '89 season, as well as the usual club events. New features are an enlarged pit area for more elbow room around the flight box and an improved frequency tree to avoid some potentially hazardous conflicts.

As far as flying goes, it seems that the Ancient City R/C Flyers will give the contemporary format of combat, or pattern, flying a whirl. Although some of the planes mentioned in their newsletter seem to be of the more docile and "user-friendly" types, this group has tried a number of experiments, including towing a glider with a Nosen trainer. Elated by the success of the experiment, the brave pilot, Joe Lippo, began a series of touch-and-gos sans glider, and he found the lone pine tree at the end of the runway. Ooops!

The staff of *Model Airplane News* is happy to award two one-year subscriptions to the Ancient City R/C Flyers, to be given by them to a couple of the club's outstanding members (maybe one to Joe, so he can thumb through for a plane to replace his!). ■

GOLDEN AGE

(Continued from page 99)

Comparison is again interesting: Today we can have four or five proportional channels with a total airborne weight of less than 5 ounces. The Purdue single-channel airborne weighed nearly 1½ pounds, the 4-channel cam weighed 5½ pounds, and neither had actuators!

The development of all this is an interesting story. Would you believe that a major obstacle was learning how to fly R/C? Remember, this was all so new and there was no one to tell them how R/C models flew. The technicalities may be dull to some, but it does seem most important for us all to share this little-known episode in our R/C history. Once done, we can get back to our own times and current happenings.

The Vintage R/C Society membership drive is gathering momentum. Have you joined yet and passed the word on to your friends? Now is the time to get a prestigious charter membership and keep that ball rolling! ■

Giant Steps

by DICK PHILLIPS

I'VE TALKED ABOUT large scale models for the past couple of columns. Building a contest-class scale model is only the beginning. While a scale model has to do well in static scoring, if it isn't flown well, the effort put into painting and detailing will have been wasted time. When a scale model is to be flown in competition, there are a number of ways to better flight scores. First and foremost among them is the ability to fly well, and that's a given. The contestant who does well in scale contests is the one who can fly well. He got that way through the simple expedient of practice. If you don't fly *regularly,* you won't fly *well.*

Once the contest model or models have been built, it's time to practice flying in order to develop a routine that gets better and better and doesn't vary. The practice routine should be as nearly identical to the contest routine as is possible. The contestant's caller should be with him during the practice sessions, and practice should continue until the routine becomes habit.

Having more than one model is also a good idea. Building two models concurrently isn't twice the work of building two models consecutively. When you have two contest models available, there's less pressure to be careful with the only available model, and a more comfortable routine can be developed when you're not faced with the loss of a model meaning the end of contest hopes. Now, no two models, however alike they might seem, will fly exactly the same, but it's worthwhile to get them as similar as possible. Careful work will be required in trimming both models to have them as much alike as possible. The effort will be worth the time and trouble if it results in two models that are hard to tell apart in the air.

The flier and caller are a team and should work well together. Using a "pick-up" caller should be avoided.

Lee Richter's Staggerwing shows its stuff close in to the judging line. (Photo, courtesy Lee Richter)

When it's time to develop your contest routine, you must consider the type of airplane you fly. A model capable of aerobatic flight will be a good deal more impressive if it's flown to its limit rather than flown at less than its capabilities. A high-performance model that flies simple maneuvers and doesn't exhibit its full capabilities is unlikely to score well. For this reason, it's as well to develop a routine that amply demonstrates the full capabilities of the airplane being modeled. Don't let this lead you to perform maneuvers of which the original airplane wasn't capable, because it's as bad to over-perform as to under-perform. A contest model should be flown to its capabilities, or it won't show up well in competition against models flown properly.

One of the most obvious departures we make from scale performance is the take-

off. Many of us want as much air under our model as possible—especially in the case of a scale model that has absorbed months of our time and effort. That abrupt and often far too steep departure from the strip is a dead giveaway and should be avoided. Compare your takeoff with that of a full-scale propeller-driven airplane at your local airport. The full-scale airplane usually undergoes an engine run-up before turning onto the runway for takeoff, and if equipped with brakes, your model should do the same. The full-scale climb-out is fairly gentle and proceeds at a shallow angle, and your model should imitate that gentle climb. If equipped with working flaps, they should be used as they would be used on the full-scale airplane.

When the takeoff climb-out has been completed, the full-scale engine is always throttled back to cruise power, and a model should operate in the same fashion and not fly an entire flight at full throttle. Realistic throttle operation is often neglected in model competitions, because models sometimes weigh more than they should for the power available. In the case of most large, modern models, the power available is considerable and would normally sustain flight at a level significantly below full throttle.

Another consideration is the type of airplane being represented. Obviously, a Sopwith Camel will fly much more slowly than a Hawker Hurricane, and you'll have to fly the model in a prototypical way to convince the judging panel that what they're seeing truly represents the typical performance of the original airplane. Here again, the large model is better able to emulate full-scale flight than a model built to a smaller scale.

At the club flying field, which airplane attracts the most attention?: the one that stooges around several hundred feet in the air, or the one clipping grass with the prop close to the ground? Obviously, the hot dog who flies close to the ground attracts all the attention, as long as safety considerations are observed, and this holds true at the contest flight line. Even when making a blank pass in front of the judges, the model should be flown at a low level and tipped up to show the top of the fuselage as it passes the judging panel. After all, if you're going to show the judges a blank pass, you might as well make it an impressive one. It won't be judged, of course, but the fact that it's flown competently and impressively suggests the capabilities of the pilot, and this is something that a relatively high pass won't do.

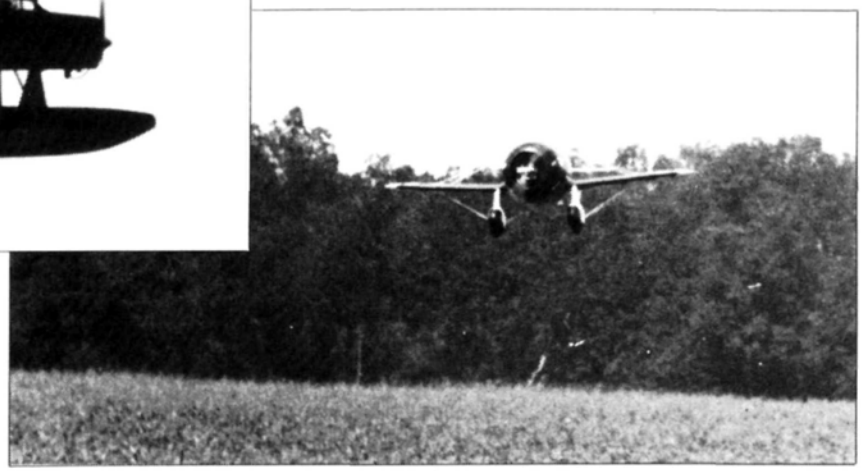
It's assumed that the model builder is more than just familiar with the airplane he has modeled. In building a contest-class scale model, he must be familiar with the look and performance of the original airplane, too. He should know exactly how the airplane flew and what maneuvers it could do and, if possible, the capabilities of the airplane should be documented. In one case I'm familiar with, a model builder produced a striking Tiger Moth that was impeccably detailed, looked great, and scored well in static judging. Now, a Tiger Moth isn't as spectacular in flight as one of the heavy iron warbirds, so it needs something of an edge to score well in flight. The builder of the model documented the maneuvers of

(Continued on page 106)

Above: Peter Scott's Blackburn looks great close in. At a distance, it wouldn't look nearly as good. (Photo, courtesy Peter Scott)

Left: The B-17 is most impressive when flown close to the judging line. Note slight, inner wing-down position.

Same airplane, but note how the addition of the front canopy cover, a pilot figure and the change to floats has added to the realism of the model in flight. (Photo, courtesy Doug McBrien)



Gee Bee Heading straight down the line is much more impressive than at a distance of 100 yards. In 1932, Jimmy Doolittle flew the full-scale Gee Bee in Cleveland at about the same scale altitude.

which the Moth is capable, had a sketch of these maneuvers signed by the secretary of the Tiger Moth Club in England and made copies of the sheet on which these sketches appear. When the model is flown in a contest, he presents the judging panel with a copy of the sheet, describes the maneuvers he will fly, and then does exactly those maneuvers and does them well. As you might expect, his model does very well indeed when entered in scale contests.

To sum up, practice, practice and practice are the three basic rules for improving your flight scores; there's no substitute. Develop a contest routine that shows your model at its best, and don't deviate from it without plenty of practice before implementing the changes in contest work. Fly the model exactly as the original full-scale airplane would have been flown, and let the judges know that you're doing so. And then practice some more! You'll be pleasantly surprised at the results.

A couple of interesting items came to hand recently. Both are publications available to the general public and could be of interest to many among us.

The first is a small newsletter called "Jets," which is devoted to amateur jet engine builders and is available from Al Doyle*. Even if you aren't a jet engine builder, you might be interested in keeping in touch with what's going on in that area. An annual subscription costs $12 (USA) and $15 to other countries. The December and January issues are numbered 24 and 25, so the newsletter has been available for a couple of years. The two copies I received are five pages long, and the reproduction is quite good. The newsletter covers a multitude of topics and includes some material on full scale. Written in a very folksy style, it makes interesting reading, even if you aren't jet oriented. If you're interested, drop Al a line at the address shown at the end of the article.

The other newsletter I received is put out by a group calling itself ACE, which stands for "Aviation and Computer Enthusiasts"*. The issue I have is numbered Vol. 3, No. 6, so it too has been around for a while. As its title suggests, the newsletter covers topics of interest to those who are aviation and computer oriented. In this 10-page effort, the topics discussed are wide-ranging and include info on full-scale airplanes as well as models. While possibly of more interest to full-scale aviation/computer enthusiasts, there's something for model builders, too. Here again, if you're interested, contact ACE at the address shown at the end of the column. The annual cost is $10.

My interest was linked to the fact that my partner and I are currently readying a book on model-related computer programs for publication. The book was written by Curtis Givens of Dayton, OH, who has become more than proficient in the development and editing of computer programs that are of value to those of us who build and fly model airplanes. Curtis has been working on the book for almost two years now, and he has presented some interesting work. Several of the programs are in my own arsenal and I use them frequently. Using a computer to output a printout of the ordinates to be used to plot an airfoil at a specific chord is much more convenient that working with a calculator, a pencil and paper. The ease and speed with which the same airfoil can be plotted at a different chord is a great help. There's even a program to calculate the terminal velocity of a model headed straight for terra firma, although Curt admits this one hasn't been tested in practice (something to do with a lack of volunteers willing to dive an airplane straight into the ground for test purposes!). The book should be on the market late in '89.

**Here are the addresses you might need:*
***Jets,** Al Doyle, 4015 San Jacinto #404, Houston, TX 77004.*
***ACE,** 2009 Camelot Dr., Las Cruces, NM. 88005.* ■

ABOUT THOSE ENGINES

(Continued from page 53)

les with the points: arcing, pitting and radio-system glitching. As for interference generated by the spark plug itself, it can usually be stopped by simply adding a 10K 1/4W resistor at the plug end of the high-tension lead. In any case, Floyd furnishes full instructions with his TIM-3 modules, including how to solve any possible R/C interference problems.

I rather like spark-ignition motors myself. It's not just because they were the model airplane engines that got me started in gas power so many years ago. It seems that sparkers have personalities all their own. True, once in a while, they can be stubborn and uncooperative, but, when they're running right, their operating flexibility rivals that of a model "diesel." Correctly adjusted, a sparker will spin just about any size of propeller you care to fit onto its shaft. Ken Willard once shocked a lot of "gas-engine experts" by successfully running a tiny Atom .097 with an 18-inch-diameter prop. It certainly didn't turn fast; but it kept right on ticking over merrily until Ken cut the ignition switch.

**Here are the addresses of the companies mentioned in this article:*
Herb's Model Motors, *P.O. Box 61, Forksville, PA 18616.*
RJL Industries, *P.O. Box 5, Sierra Madre, CA 91025.*
Aero-Ply Research Co., *2029 Crist Dr., Los Altos, CA 94022.* ■

HELI CHALLENGE

(Continued from page 56)

open the throttle all the way, and push on the forward-cyclic control. As the helicopter gets right in front of you, pull back on the cyclic-pitch control and start the helicopter climbing upward. Keep pulling back as the helicopter comes up to the top of the loop. The amount of cyclic pressure that's needed will vary from one machine to the next. Don't start out by sharply pulling back on the stick and just hanging on. Use the full cyclic control only if you have to. If everything doesn't look or feel right, abort the loop by easing in forward-cyclic control until the nose pushes back to level and recovers into forward flight. You might want to plan on aborting the first attempt at this stage, if you feel a little timid. This is fine, and might even be the smart way to go, as it allows you to get the feel of how the helicopter will react.

Let's continue with the loop that we originally started. As the helicopter comes

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NAME THE PLANE CONTEST

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to **Model Airplane News**, Name the Plane Contest (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Gordon Rosenthal of Jericho, NY, for correctly identifying the Beech Model 73 Jet Mentor shown in our April issue. Gordon's entry was drawn from the 12 correct answers submitted. In addition to identifying the Beech, Gordon had actually *flown* the singular example and reports that it lost the competition to the Temco TT-1 Pinto. As a result, the Navy and the "taxpayers lost out in not picking it!" History has ways of repeating itself, doesn't it?

The Model 73 shared many of the components used on the very successful Beech T-34 Mentor and Bonanza series airplanes. Its first flight took place on December 18, 1955. Spanning 32 feet, 9 inches, with a length of 30 feet, the Jet Mentor had a max speed of 295mph at 15,000 feet. Propulsion came from a single Continental J-69-T-7 turbojet producing 920 pounds of thrust. Its crew of two was housed, in tandem, beneath a virtually frameless clamshell canopy.

The fact that it was a prototype seems to have been the reason that such amenities like dual instrumentation, air conditioning and pressurization, and ejection seats were intended to be optional. Some of these features are still "optional" on today's trainers like the T-37. Once again, history....

The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

HELI CHALLENGE

(Continued from page 111)

over the top of the loop, ease off of the cyclic stick pressure, and reduce the collective pitch to approximately zero. If you have your machine set up for a fairly constant rotor speed, it will have a tendency to unload at the top without loss of rotor speed, and depending on the amount of negative pitch that you have available, you might find the helicopter actually *gaining* some altitude at the top of the loop. If your helicopter isn't set for much more than a standard throttle/collective system, you'll have to be sure that you keep the throttle up a little. In this case, don't pull the throttle below the hover point, since you're interested in keeping the rotor speed up to at least a normal hover. Be sure that you back off the cyclic pitch. The natural reflex while pulling the helicopter through the loop is to try to pull it through as quickly as possible. This is really the *opposite* of what should be done, since you're trying to make the helicopter exit at the same altitude as it entered. If the cyclic pitch is pulled back through the top of the loop, it will tend to tuck the nose under in a sort of controlled fall and produce a figure-9 in effect.

The top of the loop is the most critical point of the maneuver. The helicopter will be at its slowest point here, and the rotor disc has to endure a change in load with the mass of the helicopter moving from *under* the rotor disc to *over* it. Engine torque will continue to try to twist the helicopter around its mainshaft and, all the while, gravity is trying to suck the machine into the ground. Besides having the machine move smoothly through the loop as you get your helicopter onto its back, a few other things can happen, e.g., it suddenly stops moving, the tail spins around, or the machine falls off to one side. You'll probably wind up experiencing every one of these things at one time or another as you work on doing loops. The first thing to keep in mind is *don't panic*, and don't immediately grab full-back stick. To be sure you have maximum power, you must get the throttle open, and then you should momentarily neutralize the controls, except for the throttle. Let the helicopter drop for a second or so, and get a feel for the helicopter's attitude. This will get the air speed back up a little, while you regain your composure.

Now determine what control is needed to get the helicopter back to level flight. If the helicopter is falling on its side, roll it upright with roll cyclic, and then pull the nose up to level with the back cyclic. If the helicopter is coming down tail first, you should push forward cyclic until the tail is pointing straight down, and then kick tail rotor as if you were doing a stall turn, and recover to level flight by pulling back on the cyclic pitch once the nose is headed down. If you pull back on the cyclic pitch as the helicopter is coming down tail first, you might run out of time

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Classified

WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

SCALE DOCUMENTATION: Plan Enlarging. Photo packs, 3-view drawings for 1,600 aircraft. Super-scale R/C plans for Giant, Sport. 80-page catalog $4. Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; (919) 292-5239.

PLANS ENLARGED, Large Scale Specialists. PC Model Software. Free catalog. Concept, P.O. Box 669E, Poway, CA 92064; (619) 486-2464.

WANTED. Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

GIANT SCALE PLANS by Hostetler. We fly what we draw. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667.

STRIPPED GLOW PLUG THREADS REPAIRED with stainless steel Heli-coils. 2-stroke heads $7.50. 4-stroke $10, postpaid. Send head only. Lee Custom Engines, 10112 Woodward Ave., Sunland, CA 91040.

MAKE A BEERCAN BIPLANE, 9 inches with 14-inch wingspan, $9.95. Kit Three, Box 72104, Marietta, GA 30007.

ENGINES: IGNITION, GLOW, Collectors, runners, used, new. Sell, trade, buy. SASE for list. Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537.

ALL ALUMINUM P-51D Mustang and P-51B Mustang III Precision 1/4 replica scale R/C kits. Extraordinary museum detail and a thrill to fly! All aluminum chemically milled and cut-out/drilled/formed—ready for assembly. Forty-five sold to date. Complete kit $3000. (Less engine & radio.) Sample rib section and details $25 or SASE for info. Warbirds Aviation, 122 Naubuc Ave., (NAP Bldg.), Glastonbury, CT 06033. (203) 657-3595.

OLD TIMERS, take a ride back in time to airplane modeling roots with this vintage book—*Gas Models*. A true collector's book from the early editors of *Model Airplane News*. It contains the best of modeling from the '30s and '40s, including great technical information and classic construction articles from the Golden Age period. $7.95, add $1.75 S&H; Foreign Surface Mail, add $2.75; Foreign Airmail, $5.50; Payment must be made in U.S. funds drawn on a U.S. bank or by an International Money Order. Air Age Mail-Order Service, 251 Danbury Rd., Wilton, CT 06897.

IMPORTED DIESEL ENGINES—WORLD'S BEST SELECTION: Current production Aurora, Cipolla, D-C, Enya, KMD, Mikro, MK-17, MVVS, PAW, Silver Swallow & USE Diesels. Also Mills and Taplin Twin replica diesels and very special imported glow engines. Catalog $1. CARLSON ENGINE IMPORTS, 814 E. Marconi, Phoenix, AZ 85022.

DISCOURAGED BY TOO-FAST R/C TRAINERS? Ease-of-flying ratings of over 30 popular trainers, $2. Jim Waterman, 3818 Deerfield Dr., San Antonio, TX 78218.

BARGAIN HOBBY SUPPLIES: Everything for the free-flight enthusiast. Balsa, tools, kits and more! Send SASE to: Discount Hobby Supply, 629-A South Breed St., Los Angeles, CA 90023.

NOW, OAK FLIGHT BOXES! Last a lifetime. New designs for easy handling. Extra convenience. Kits or finished. Free radio flyer decal, catalog. Write: S & D Model Products, P.O. Box 4026R, Des Plaines, IL 60016.

ANTIQUE IGNITION AND GLOW PARTS CATALOG: 75 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, Atoms, McCoys, others. $8 postpaid. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

EMBROIDERED EMBLEMS, Enameled Pins, Your Design, Excellent Quality, Free Booklet, A.T. Patch Co., Dept 68, P.O. Box 682, Littleton, NH 03561, (603) 444-3423.

WANTED: RTF U/C planes and U/C race cars, mite cars; complete or pieces, with or without engines. Buy or trade. John Fietze, Box 1521, Amagansett, NY 11930.

USED AVIATION BOOKS. Free catalog. Want lists welcome. Dan F. Webb Books, Box 6366MAN, Moraga, CA 94570.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

RAZOR BLADES, single edge, carbon steel, first quality industrial. $5 per hundred plus 10% shipping. COBBIE'S GIFTS, RR 2, Box 454-A, Staunton, VA 24401, (703) 885-8036.

FOR SALE: *Model Airplane News*, 1949-1977; also *Aircraft Modeler, Aero Modeler*. List available. Bill O'Berry, 411 Ben Oaks Dr. West, Severna Park, MD 21146.

25 DIFFERENT PAPER AIRPLANES, $5 postage paid. Folded Flight & Kite, Box 41, Santa, ID 83866.

ENGINE VIBRATION ISOLATOR MOUNTS. Four rubber mounts with 10-24 socket head bolts. $6.50. Penron Products, Box 13051, Arlington, TX 76094-0051.

COST OF R/C GOT YOU TIGHT FOR CASH?! Exclusive report shows you how to start earning money NOW with your knowledge of R/C! For Information Package, send $2 to: REALISTIC CONCEPTS, 40-3 Ushirokubo [Soir K], Room #103, Misawa City, Aomori Ken, Japan 033. [Postage to Japan is 50¢. (2 stamps)]

ALL ALUMINUM P-51D CONVERSION KIT for your 1/5 scale fiberglass model. Convert your existing P-51D model to all-aluminum. Extraordinary museum scale. Use your existing engine and drive line, landing gear, radio and servos. Complete kit $2500. Warbirds Aviation Conversion Kits, 122 Naubuc Ave., Glastonbury, CT 06033 (203) 657-3595.

LIQUIDATING most of my model plane kits, supplies and accessories due to age—mine! Send large stamped envelope for 10-page list of Quarter Scale and regular R/C kits, engines, sailplanes, wheels, propellers, spinners and pilots. Robert Hawkins, 1200 E. Calle de la Cabra, Tucson, AZ 85718.

WANTED: Japanese twin-engine bombers, plans or kits. John C. Fredriksen, 69 Flamingo Dr., Warwick, RI 02886.

FOR SALE: Platt 1/5-scale kits. Zero and Focke Wulf. Also Royal, Top Flite. SASE for list. C.A. Abernathy, 10206 Windbluff Dr., Richmond, VA 23233.

WANTED: AQUILA OR AQUILA GRANDE. Top dollar for boxed, unassembled. Also looking for complete or partial (undamaged) Aquila. Spare parts: canopy, fiberglass or plastic fuselage. Send list, including condition and value. James R. Schneider, 545 Buttonwood Dr. #C, Danville, CA 94526.

PRECISION COMPUTER CUT LETTERING for planes, boats, cars—models or full scale. Free information. Write: AeroGraphics, 511 W. Franklin Blvd., Gastonia, NC 28052. (704) 864-2038, 4-10PM (Eastern).

PRIVATE COLLECTION: Hundreds of aviation magazines for sale: *Popular Aviation, Flying, Model Airplane News, Air Trails, RAF Flying Review, Wings* and many others. 1932-1960. All in excellent condition. Send $2 for list. William C. Fort, Jr., 4161 Robin Hood Rd., Jacksonville, FL 32210.

MODEL AIRPLANE MAGAZINES, from the 30s to date. Send large SASE to Jim Robertson, 35 Stonecrest, St. Joseph, MO 64506.

ELECTRIC FLIGHT EQUIPMENT: *We cater to the electric flyer*. The best and largest electric flight supply in the Northeast. Specializing in ASTRO FLIGHT Equipment. Kits, motors, batteries and lightweight building supplies, plus everything else you need for electric flight. Send $3 for catalog to CS Flight Systems, 31 Perry St., Middleboro, MA 02346, or call (508) 947-2805 to order. Visa & M/C.

CUSTOM EMBROIDERED PATCHES. Your design made any size, shape, colors. Five patch minimum. Free random sample and brochure. Hein Specialities, 7960 S.W. Manitou Trail, Glen Arbor, MI 49636.

FREE INFORMATION on digital battery tester for R/C battery packs. Prevent crashes! Much more accurate and easier to read than analog types. Very compact. Model Aviation Products, 198 Tyler Creek St., Box 203, Gilberts, IL 60136.

Send ad and payment to *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. **Non-Commercial classified ads** (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each. **Commercial classified ads** (rate applies to anyone selling on a commercial basis–retailers, manufacturers, etc.) Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number. **Closing Date** for either type of ad is the 20th of the third preceding month (for example, January 20th for the April issue.) We do not furnish box numbers. If you would like your ad run in more than one issue, multiply amount of payment by number of months that ad is to run. It is not our policy to send sample copies of tear sheets.

HELI CHALLENGE

(Continued from page 114)

before the helicopter pulls through to upright. You'll have to use your own judgment here.

Once you get the helicopter over the top, begin the last half of the loop and complete the circle. As the helicopter flies through the top to about the 110-degree position, begin to feed in back-cyclic pitch once again. Don't overdo it at this point, as there's still a chance of a stall. Let the helicopter drop its nose, and as the nose points straight down, feed in collective pitch back up to full power. Finish the loop by continuing to pull back cyclic pitch until the nose returns to the upright position. Make your exit straight and level. About the only trouble you can get into on the back side of the loop is overcontrolling the cyclic and creating a stall, or undercontrolling the collective and causing the helicopter to exit the maneuver low.

The key to doing nice loops is to practice and get a feel for your machine. Not every helicopter will do great loops. If your machine is a little underpowered, you'll have to really "finesse" it through the maneuver. Some helicopters will let you just haul back on the stick and will whip right through a loop. Just be sure to start with plenty of altitude, and experiment a little with the controls as you fly the loop. I think you'll have fun doing it.

That sums up the loop. If you want to add a little extra something to the loop, try kicking full tail rotor at the very top, and try to catch the tail right back on heading, finishing the loop as usual. It looks neat in the air!

Next month, I'll work on the roll. I'll also be moving to *MAN's* new helicopter section. Hooray, someone *is* listening!! Pitch in with your suggestions. Until then, keep working on your flying. There's no substitute for practice. See you then! ■

ACE BIPE

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sport fliers. In short, this is a biplane that can be tuned to your needs with simple changes in CG and surface throw—mild or quick!

The airplane's structure is very strong and, with all that lite-ply, it's nearly bulletproof. The fuselage of the 4-120 bipe uses no balsa at all; surprisingly, this gives it a relatively light structure that's strong enough to bat home runs at Yankee Stadium. Its wing uses spruce for main and secondary spars and balsa for ribs, leading and trailing edges and sheeting.

Vertical and horizontal stabilizers are built of a lite-ply core and surface balsa for shaping, so they're strong, light and nearly warp-proof. Here's where one of those little Mathews' tricks shows up: The basic construction nets you automatic pockets for the supplied Robart* hinge points—no drilling or alignment is necessary!

I can't say enough about the main landing gear. This item is made of reinforced fiberglass, and it has enough spring to absorb shocks, but I doubt you could ever break it. It certainly can't be bent as typical dural gears are!

The hardware selected for this kit is all first-rate and heavy-duty, and the materials provided and the procedures described gave the best, most slop-free control systems I've ever had.

There's a quality to the 4-120 bipe that may not have been intended by either Doc Mathews or Ace, but perhaps they did! I'll

call it the chameleon factor: You can't look at this biplane without thinking that it looks like a PT-17, a Curtiss design, a Fokker D-V II, or a deHavilland something-or-other. Indeed, with only a paint scheme and perhaps some cosmetic changes to tail surface shape and engine cowling, the 4-120 biplane can be made into a "kinda" scale model of any bipe from yesteryear. I chose the blue-and-yellow scheme of early Army biplanes, and many of my flying buddies felt it was something more than a Sunday flier. It isn't scale anything, but it's "kinda" scale everything; only your imagination limits the possibilities! One last note: Although I haven't tried it yet, the 4-120 biplane appears to be nearly ideal for float operation. You can bet I'll find out this summer!

CONSTRUCTION: The airplane's structure is straightforward and well within the capabilities of any R/Cer beyond the absolute novice stage. I used Hot Stuff* CAs throughout, and epoxy only where indicated in the instructions. The parts fit was so good that thin Hot Stuff did most of the joining.

The fuselage parts are interlocking and very easy to assemble, and the result is straight and strong. When sanding lite-ply surfaces, I suggest being very aggressive. I used 50-grade production paper for initial sanding and shaping, followed by 80-grade and finally 120. The heavy paper really cuts the poplar and saves a lot of muscle power that lighter grades would expend.

Instructions suggest the Hot Stuff/3M 77 Spray pinless method for constructing the wings, and, believe me, if you want quick, straight wing construction, this is the way to go! Simply spray a light coat of 3M 77 Spray Contact Cement on the building surface, and, when dry, set the plans in place. Don't worry: If a light coat is allowed to dry for 10 minutes or so, everything in this procedure can be peeled away—the bond isn't permanent.

Next, spray the fixed plan with 3M 77 and set wax paper in place, then spray the wax paper with contact cement. You end up with a protected plan surface with enough grip to firmly hold any part you place on it. When finished, the wing half can be popped off with a steel straightedge.

When the building surface is prepared, wing construction is only limited by how quickly you can place the parts and hit the joints with Hot Stuff. I built all four wing panels in only three hours—and I'm slow!

By the way, 3M 77 is great for placing fiberglass cloth to center sections. Spray the cloth, allow it to dry, smooth it into place and flow on thin Hot Stuff. The result is clean and requires very little sanding.

Construction went quickly, and I had a finished, sanded airframe in less than 40 hours. Go over all structures really well with a sanding block. Keep in mind that the difference between an expert and a beginner is the thickness of a piece of sandpaper.

As I said earlier, there's nothing I can add to a very clear set of instructions—if you go wrong, you can't read! I did, however, make one minor change in the building procedure. I center-drilled two points on the fin base to place 1/16-inch dowels that mated to similar holes on the stab center line. This allowed me to control alignment much better than I could with a simple butt joint.

My 4-120 bipe was completely covered with Black Baron* film. This stuff goes on easily over the most complex curves. And, once on, it never releases. (My film covering efforts have taken a leap forward ever since I tried Coverite's great covering film.) I also used Coverite's Graphics

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ACE BIPE

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trim film for those few color spots I needed. The roundels are from Major Decals.*

Power for my 4-120 bipe came from a Saito* FA-120 4-stroke engine on a 16x16 propeller from Top Flite*. The engine proved to be reliable throughout my flight tests; although it was difficult to start by hand, this problem was solved with an electric starter. Before it could hold a setting for maximum power, the Saito seems to require much more break-in than other 120 4-strokes I've had. When all the moving parts were well acquainted, the engine was quite powerful with an excellent idle and mid-range.

Radio chores were handled by my latest single-stick (in my opinion, the only way to go), the Futaba* PCM. This is a great radio and I look forward to many years of happy operation. At last I've found a replacement for my Kraft Signature single-stick—it's about time!

PERFORMANCE: Initial flight tests were conducted with surface throws and CG as suggested in the instructions. The flight went well, although it was a bit on the tame side and had a somewhat sluggish response. In subsequent flights, I moved the CG to the most rearward suggested position and at least 20 percent more aileron throw. The tame quality went away, and the biplane became much more maneuverable. An improving Saito powerplant (after about an hour's running) also helped, as did a change to a 15x8 Dynathrust* propeller.

The airplane probably needs more power for those seeking maximum vertical performance and I suggest something in the hot 90 2-stroke range, but this would eliminate that lovely 4-stroke sound that's so much a part of this airplane's charm.

Looking and sounding just like a '30s bipe, the airplane started to respond with crisp maneuvers and, even with an aft balance, it didn't become "stupid" when landing. This is the easiest biplane to takeoff and land I've ever flown, and you can fully tune the Ace 4-120 to your flying style.

This airplane is going to be around for many, many years. It's easy to build and set up, it flies beautifully and, with its wide speed range, will suit low- and high-time pilots. What else could you expect from a kitted airplane? Ace has a winner here and Cap'n Eddie should get rid of that scowl on his face. This biplane should surely make him smile! Ace and Doc Mathews should be smiling, too.

**Here are the addresses of the companies mentioned in this article:*
Ace R/C Inc., *116 W. 19th St., Higginsville, MO 64037.*
Robart Mfg., *P.O. Box 1247, St. Charles, IL 60174.*
Hot Stuff; *distributed by Satellite City, P.O. Box 836 Simi, CA 93062.*
Black Baron; *distributed by Coverite, 420 Babylon Rd., Horsham, PA 19044.*
Major Decals, *21 Fisher Ave., East Longmeadow, MA 01028.*
Saito; *distributed by United Model Distributors, 301 Holbrook Dr., Wheeling, IL 60090.*
Top Flite, *2635 S. Wabash Ave., Chicago, IL 60616.*
Futaba Industries, *4 Studebaker, Irvine, CA 92718.*
Dynathrust Props, *2541 Northeast 11th Ct., Pompano Beach, FL 33062.* ■

CHARGER

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knees, but my fears were quickly dissipated. The takeoff was very easy: straight down the runway with no correction of rudder. The Charger II was soon airborne and climbing out in an exemplary fashion. I made a trim adjustment of only two clicks of aileron, and that was it! The plane flies "on rails" with absolutely predictable (and controllable) characteristics.

I haven't yet had time to put the model through a challenging aerial program, but I don't doubt that this will become a favorite of mine for sport flying activities. It's a real winner!

**Here are the addresses of the companies mentioned in this article:*
Walt Moucha Models, *P.O. Box 112, Menominee, MI 49858.*
Enya Engines; *distributed by Altech Marketing, P.O. Box 286, Fords, NJ 08863.*
Tatone Products Corp., *21658 Cloud Way, Hayward, CA 94545.*
Sullivan Products, *1 North Haven St., Baltimore, MD 21224.*
Black Baron; *distributed by Coverite 420 Babylon Rd., Horsham, PA 19044.*
Fiberglass Master, *Rt. 1, P.O. Box 530, Goodview, VA 24095.*
Sig Manufacturing Co., *401 S. Front St., Montezuma, IA 50171.* ■

PITTS

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method again, because it appears to work extremely well. At any rate, if you plan to use the bigger engine, be prepared to modify the front end.

Fit the cowling when the engine has been installed. The Super Tigre S2000 fits entirely inside the cowl, and only two holes were required for access to the high-speed and low-speed needle valves. This was accomplished by using the Tatone* Pitts-style muffler, and a remote glow-plug adapter from McDaniel R/C*. This results in a very clean, scale-like appearance with just the two exhaust tubes protruding from the bottom of the cowl.

The design of the landing gear is unique, as there are two plastic fairings screwed to the fuse and joined by a center $^{5}/_{32}$-inch wire strut. The strut bends up toward the center bottom of the fuse and rides in a slot cut in the fuse by the builder. The gear will work pretty well, but you should reinforce the slot with plywood to prevent it from cracking open. The plastic fairings were painted with K&B* Superpoxy, after I'd unsuccessfully attempted to dye them with Rit dye. The Superpoxy began to flake off the struts

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PITTS

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after the first flight, and the slot began to open up and cause the plane to lean to one side. Needless to say, I wasn't happy with this, and I asked one of my machinist friends to make me an aluminum landing gear.

No wheel pants were included with the kit, so you're on your own here. I had two sets of unfinished wheel pants in my collection, and I wound up trying both sets. The first set appeared to be the right size, so I painted them and used them for the first flights. However, some of my flying friends thought that they were too small, and I've since replaced them with the larger set. A Pitts needs wheel pants to look like a Pitts, so they should have been included in the kit.

The final phase of construction is the assembly of the tail feathers followed by radio installation. There were no real snags here, but I opted for a wooden servo tray instead of using the plastic one included. I chose this route because I wanted to have the elevator and rudder servos moved to the rear of the radio compartment so that shorter, less flexible, pushrods could be used in an attempt to reduce control slop. On a final note about framing: Be sure that you take the time to accurately align all the flying surfaces, because a little effort here can allow the true characteristics of your ship to show from the very beginning, and it will also get you into trim much more easily later on.

To keep the weight down, the model was finished by filling the very few fuselage imperfections (mostly along the seams) with spot putty and coating the wooden tail surfaces with .6-ounce glass cloth and polyester resin (two coats). Primer was sprayed onto the tail feathers to fill the remaining weave of the glass cloth, but no primer was needed on the fuselage. The fuse, cowl and tail were sprayed with two light coats of K&B Superpoxy, and the wings were covered with Super MonoKote*.

My paint scheme wasn't copied from any full-size Pitts, but was designed using a paint program on my personal computer. Finishing details included a Williams Brothers* 1/4-scale pilot, which I painted and installed under the tinted canopy.

The finished model weighs almost 13 pounds! According to the plans, the machine should weigh exactly 10 pounds. I'd never expect anyone to get close to this

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weight, even using a .60 engine, since using a .60 would only reduce the weight by about 1 pound. Back to my original observation: I think that using laid-up glass parts would take 2 pounds off the total weight. Having weighed this ship before its first flight, some of the wind was knocked out of my sails and some doubts arose about flight performance. Anyway, I headed for the flying field.

PERFORMANCE: When I'd filled the 20-ounce fuel tank and the smoke-oil tank, the engine started on the first flip and took the throttle shortly afterwards. The engine has a Rev-Up* 16-8 prop, and running it at full throttle on the ground revealed a very smooth and quiet combination. Contrary to some concerns by owners of other Pitts kits, the takeoff roll was quite straight (much of this results from toeing-in the main gear on each wheel by approximately 5 degrees).

When the Pitts broke ground, it soon showed that the air was really the element for which it was created. What a flier! I was absolutely amazed at the obvious docility and predictability of this plane's flight traits. Without wanting to sound over-enthusiastic, I'll just point out that this is a great airplane. I won't say that it jumps off of the board without touching a single trim, or that it has no unusual habits, but I'll give you an honest report on how the Pitts does fly and what you can expect from it.

First, the airplane has a very solid control "feel," and it's responsive to every control input. Slow-flight characteristics display no tip-stall tendencies—just a nice drop of the nose at the stall point and a gentle recovery when the air speed builds back up. Pulling the nose straight up to vertical, the airplane will follow the line well until the drag begins to take over and the airplane tries to torque to the left. Rudder will correct this condition up to just before the stall. Loop-tracking is fairly good, although loops do require a little effort to keep round and in line. Rolls are axial and require minor corrections of rudder and elevator as you work through them.

Point rolls are another story, and they need to be grouped with knife-edge flight. When the airplane is rolled up onto the knife-edge on either side, it will try to roll out back to upright, and it will pull toward the canopy as the top rudder is applied. The rolling-out tendency is most severe when the top rudder application is to the left. Trimming the knife-edge here would require a lot of effort, if it has to be done mechanically, but the tendency to roll out of the knife-edge is supposedly normal for a bipe. If you're lucky enough to have a radio system that will allow you to mix

any two channels, you can quickly correct this problem. I used a JR* Galaxy Computer 8 radio system, which offers two such mixers. Using the Galaxy, I was able to mix opposite aileron into the rudder to counter the rolling tendency, and I mixed down-elevator with rudder and countered the pulling toward the nose. Presto! Instant hands-off knife-edge.

Spins and snaps are exciting: The airplane will recover immediately from a snap-roll, whereas input of opposite controls on elevator and rudder stop the spin. You must keep this in mind, especially if you're doing flat spins, since the airplane will crank into these and flatten right out, and it won't recover just by neutralizing the controls. At any rate, the snaps and spins are very scale-like, and they always please the crowd.

Landings are pretty easy; just be sure that you don't get the airplane slowed up too far out, since biplanes won't glide as long as monoplanes will.

Finally, the Super Tigre S2000's performance is adequate, but it really isn't overpowering this airframe. If I were doing this again, I'd try either the S2500, or the S3000 version of this engine, since they have the same external dimensions and they weigh about the same. This should give a slightly improved vertical performance without sacrificing docility. I don't think the airplane would perform well with a .60 in it; there's just too much drag with the two wings, and you'd still be pulling around a 12-pound bird. A .90 might work OK, but you'd have the scale equivalent of a Pitts with a 120hp to 140hp powerplant, and most full-size aerobatic pilots would tell you that this wouldn't be much fun.

In summary, the Pitts builds easily, flies well and is a nice addition to any sport-scalers collection. The large size makes it look more realistic when it's flying, and it has great crowd appeal.

I think that Phil Ramsey was a little carried away with the plastic parts situation, as nearly half of those provided wound up in the garbage! On the other hand, the plastic parts that I did use worked really well. If the fuse and cowl were laid-up parts, this bird would be a dazzling performer for the IMAC circuit, but the present weight of the Pitts makes me think that it would be only a mediocre contender in this category.

**Here are the addresses of the companies mentioned in this article:*

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PITTS

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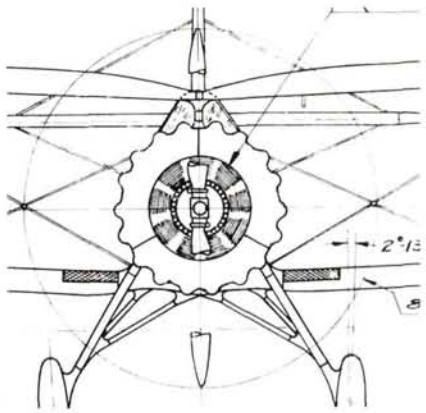
Cambridge Models, *P. O. Box 26, Norwood, NJ 07648.*
Indy R/C Sales Inc., *10620 North College Ave., Indianapolis, IN 46280*
Tatone Products Corp., *21658 Cloud Way, Hayward, CA 94545.*
McDaniel R/C Inc., *12206 Guinevere Rd., Glenn Dale, MD 20769.*
K&B Manufacturing, *12152 Woodruff Ave., Downey, CA 90241.*
MonoKote; *distributed by Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.*
Williams Bros., *181 Pawnee St., San Marcos, CA 92069.*
Rev-Up; *distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.*
JR Radio; *distributed by Hobby Dynamics, 4105 Fieldstone, Champaign, IL 61821.* ■



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